CONCEPTUAL APPROACH FOR REMEDIAL INVESTIGATION COMBE FILL SOUTH LANDFILL MORRIS COUNTY, NEW JERSEY

REMEDIAL INVESTIGATION/
REMEDIAL ACTION SELECTION
STATEWIDE TERM CONTRACT NO. A-47449

SUBMITTED: January 27, 2004

Prepared for:

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
SITE REMEDIATION PROGRAM
401 EAST STATE STREET
TRENTON, NEW JERSEY 08625

Prepared by:

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January 27, 2003

Mr. Anton Navarajah, Site Manager
New Jersey Department of Environmental Protection
Division of Publicly Funded Site Remediation
Bureau of Site Management
401 East State Street, CN 413
Trenton, NJ 08625

RE: Conceptual Approach for Remedial Investigation of the Bedrock Aquifer
Combe Fill South Landfill Superfund Site, Morris County NJ
Term Contract for Remedial Investigation/Remedial Action Selection
Contract No. A-47449

Dear Mr. Navarajah,

On Thursday October 2, 2003, the Louis Berger Group, Inc. (Berger) conducted a site visit with the New Jersey Department of Environmental Protection (NJDEP) in preparation for the background review of the Combe Fill South Landfill (Landfill) Superfund Site. Based on the review of background material provided by the NJDEP, Berger provides the following summary and Conceptual Approach for the Remedial Investigation of the Bedrock Aquifer for the Landfill.

BACKGROUND

In 1986 the U.S. Environmental Protection Agency (EPA) published a Record of Decision (ROD) for the Landfill. The ROD stipulated that a supplemental feasibility study be conducted to evaluate the need for remediation of the bedrock aquifer. The bedrock aquifer is the primary source of potable water for the region. Additionally, as a result of the narrow deep valleys separating the flat-topped ridges and the geological structural alignments in the area, the bedrock aquifer may also contribute significantly to spring, seep and stream flows.

The following presents the regional geography and land use, soils and geology, groundwater information, and a brief overview of the SITE history and the previous investigations and remediation conducted. The Landfill site (Figure 1) is located off of Parker Road in Chester Township and Washington Township, Morris County, New Jersey and currently comprises Block 37, Lots 15, 16, 16.01 and 16.03 in Washington Township and Block 17, Lot 7 in Chester Township.

Physiography

The Site is situated within the New Jersey Highlands physiographic province. The Highlands province in southwestern Morris County generally consists of flat-topped ridges trending northeast to southwest, averaging 800-1,000 feet above mean sea level (amsl) separated by narrow deep valleys. The Site topography ranges from an elevation of about 780 feet amsl along Trout Brook to about 875 feet amsl on the top of the more recent fill sections.

Land use in the vicinity of the landfill is primarily for low-density residential housing (lot sizes are generally more than two acres) amid large parcels of cleared rolling hills. A few commercial establishments and a nursery school are located on Parker Road within one mile of the landfill. Installation of a public water line, as an alternate water supply for private wells, was postponed because ground water monitoring that was conducted for many years after the ROD was issued showed that only a small number of private wells were impacted. Accordingly, it was determined that provision of Point-of-Entry-Treatment Systems (POETS) for the impacted private wells was more cost effective and less environmentally disruptive.

Geology

The Site and regional vicinity are underlain by a series of igneous and metamorphic rocks. These units have undergone multiple phases of emplacement and deformation resulting in a complex sequence of units and a complex structural regime. In summary, sedimentary rocks were subjected to compressional forces which caused metamorphism and development of the northeast/southwest structural alignments seen in the Highlands. Following the sedimentary and metamorphic phases, the rocks were subjected to igneous intrusion resulting in the complex region observed today.

The units in the immediate vicinity of the Site (Figure 2) are two members of the Byram Intrusive Suite –the Hornblende granite (Ybh) and the Microperthite alaskite (Yba) – and are described by Volkert (1990). Joints are present in all geologic units of the Highlands. By definition, joints are fractures along which there has been little or no motion. There are at least two dominant joint sets with average strikes of N40°E and N50°W and variable dips (Volkert, 1988). Joints are more widely spaced in the massive rocks than in the well layered gneisses. The last major structural features of the Highlands are faults and these are a significant factor in the occurrence and movement of groundwater. Most of the faults in the Highlands are northeast trending, following the regional structural pattern, high angle, southeast dipping, normal faults (relative motion is down on the hanging wall and up on the foot wall). In addition, there are numerous smaller cross-faults that trend northwest and have small displacement components (Volkert, 1988).

Groundwater

The Site is located along a northeast-southwest trending ridge. The groundwater flow generally mimics the topography. As discussed, the elevation of the top of bedrock is variable. The water table is encountered in the fill material of the landfill as well as the overburden/weathered rock in some areas and in the competent bedrock in others. The upper weathered zone of the crystalline bedrock is in direct hydraulic communication with the overburden material. Although generally considered non-porous, the crystalline bedrock that underlies the Site is typically fractured and contains variably-spaced joints which tend to produce a relatively high secondary permeability.

Groundwater flows through the pore-space of the unconsolidated material and the fractures of the competent bedrock. The groundwater in both the unconsolidated material and the bedrock fractures ultimately discharges to the surface waters in the area. The overburden groundwater discharges to springs, small streams and the more significant streams. The groundwater in the bedrock aquifer appears to discharge to the more significant streams and is inferred to contribute to certain springs/stream headwaters. Locally, pumping of bedrock aquifer production wells may influence groundwater flow.

The bedrock aquifer is the major source of potable water in the vicinity of the landfill. Numerous residential wells within one mile of the Site draw water from this aquifer. There are also public wells within two miles of the landfill that tap the bedrock aquifer.

Site History

Since the 1940s, the Site was operated as a municipal refuse and a solid waste landfill, and was used for the disposal of household and industrial wastes, dead animals, sewage sludge, septic tank wastes, chemicals, and waste oils. Chester Hills Inc. owned the landfill from 1948 to 1978 when it was sold to Combe Fill Corporation, a subsidiary of Combustion Equipment Associates. In 1972, Chester Hills, Inc. received a "Certificate of Registration" to operate the Site for disposal of non-hazardous municipal and solid wastes. This action marked the first state regulatory control over the landfill operations. From 1978 until Landfill operations ceased in November 1981, the landfill was operated by Compaction Systems. Combe Fill Corporation filed for bankruptcy under Chapter 7 of the Bankruptcy Code in 1981, and was subsequently liquidated.

The existing files contained a 1988 document prepared by the EPA entitled "Aerial Photographic Analysis of the Combe Fill South Landfill Chester, NJ". This document contained ten aerial photographs from 12/1939, 04/1951, 05/1957, 05/1963, 05/1966, 02/1970, 04/1974, 07/1979, 03/1984 and 12/1987. As part of the development of this Conceptual Approach, Berger acquired higher resolution photos for 12/1939, 04/1951, 04/1961 and 04/1974 which are presented in Appendix A. From a review of the aerial photos available, the first visible evidence of landfill activities is observed

in the 1951 photo. In the 1957 aerial photo, the first evidence of a pond located on the western property boundary is visible. A 1961 photo clearly shows roads to and from this pond. The pond persists and is visible in a 1974 photo but is not visible in a 1979 and later photos. The general location of the pond is indicated in Figure 3 – Historical Areas of Interest.

In a 1963 aerial photo, there appears to be significant activity just north of the landfill property line along the power company's right of way (ROW). Later, in a 1966 photo, there is evidence of vegetative change just north of the landfill property line. Still later, in a 1974 photo, it appears that an alternate access road to the landfill is active, along the power company's ROW. By the 1979 aerial photo this access road is no longer active. Figure 3 – Historical Areas of Interest, illustrates the general location of the region with the significant activity and access road.

Soil contamination was evident in the areas where seeps discharged from the landfill. Monitoring of groundwater indicated elevated levels of organic compounds in both overburden and bedrock monitor wells and in residential wells. Surface water sampling of Trout Brook and the East Branch of Trout Brook revealed elevated levels of organic and inorganic compounds. Visual signs of contamination of these waters were also observed.

Previous Investigation and Remediation

U.S. EPA added this Site to the National Priorities List of Superfund sites in 1983. Remedial investigation conducted subsequently at the Site by NJDEP under a cooperative agreement with the EPA indicated that radial groundwater flow occurs in the overburden aquifer to off-site locations. Additionally, groundwater contamination observed in several residential wells in the vicinity of the landfill, is inferred to have originated at the Site. Many of the residential wells were fitted with POETS. Over the years samples were collected from selected residential properties and analyzed for Volatile Organic Compounds (VOCs) including Benzene, Toluene, Ethylbenzene and Xylenes (BTEX). Remedial alternatives were developed at the conclusion of the investigation. The EPA Regional Administrator issued a ROD on September 29, 1986. The selected remedy in the ROD included the following:

1. An alternate water supply for affected residences.
2. Capping of the 65-acre landfill in accordance with RCRA requirements.
3. An active collection and treatment system for landfill gases.
4. Pumping and on-site treatment of overburden groundwater and leachate, with discharge to Trout Brook.
5. Surface water controls to accommodate seasonal precipitation and storm runoff.
6. Security fencing to restrict site access.

7. Appropriate environmental monitoring to ensure the effectiveness of the remedial action.
8. A supplemental feasibility study to evaluate the need for remediation of the bedrock aquifer.

Construction of the landfill cap and the overburden ground water treatment system was completed in 1996 and they are now in the operation and maintenance phase. During the remedial construction phase, the Department and EPA decided to install a passive gas venting system as opposed to the planned active gas collection and treatment system.

During April of 1985, a number of short duration pump and packer tests were completed in the bedrock D-series wells (D-1 through D-9) located throughout the landfill. In May of 2000, a number of additional pump tests were completed on the north eastern edge of the landfill in the vicinity of monitoring wells MW-9 through MW-15. A more detailed history and chronology of events for the Site is included in Table 1.

UNDERSTANDING

The Combe Landfill South has been active since the 1940's and has accepted a wide variety of household and industrial wastes. Documentation has shown that the Landfill Regulations were not always followed which may have resulted in contaminants entering the groundwater. Some illegal dumping is reported to have occurred. The Landfill has been capped according to all appropriate federal state and local regulations.

Since the 1980's, results from periodic groundwater sampling of both the Landfill and surrounding residential wells have indicated that the overburden and bedrock aquifer are impacted with contaminants. The southwest area of the Landfill, near MW-5A and MW-6, shows evidence of contaminants in the overburden aquifer system. Likewise, near MW-1, the overburden aquifer appears to be impacted, possibly as a result of the previously described pond identified in aerial photos. This pond may have been responsible for, or a contributing source of, the contamination that was documented in the Trout Brook and East Branch of Trout Brook as well.

For the region, the overburden groundwater appears to radiate in all directions from a high generally centered north of the Landfill. The groundwater in both the overburden unconsolidated material and the bedrock fractures ultimately discharges to area surface waters. Landfill material is the most likely source of the overburden aquifer contamination. The existing on-site recovery system provides hydraulic control that appears to be effective in limiting the horizontal migration of overburden groundwater contamination.

The 1986 ROD stipulated that a supplemental feasibility study be conducted to evaluate the need for remediation of the bedrock aquifer. The bedrock aquifer is the primary source of potable water for many of the surrounding residential wells. Additionally, as a result of the narrow deep valleys separating the flat-topped ridges, and the development of the northeast/southwest structural alignments in the area, the bedrock aquifer may also contribute significantly to spring, seep and stream flows. This contribution could result in migration of the bedrock aquifer contamination to many more potentially sensitive receptors.

A data base of more than 60,000 analytical constituents, representing analytical results for POET systems surrounding the Landfill from 1999 through 2002 was reduced. Additionally, analytical results from as far back as 1985 were compiled from the Reports provided by the NJDEP. In an attempt to understand the contaminant migration issues at the Site, two analytes were selected and the analytical data from 1985 through 2001, for these two analytes, were contoured. The analytes selected were Benzene and the chlorinated solvent Tetrachloroetheylene (PCE). The reduced and contoured data are provided in Appendix B. Based on the background documents provided, as well as a review of the electronic analytical chemical records available, four areas (Figure 4) appear to require further delineation/investigation –

Area 1 – Western part of the Landfill in the vicinity of MW-1 (Figure 5),

Area 2 – Southern part of the Landfill in the vicinity of MW-6 (Figure 6),

Area 3 – Northeast of the Landfill between the Landfill edge and School House Lane (Figure 7) and

Area 4 – Regional Groundwater delineation and Interaction (Figure 4)

Areas 1 and 2 appear to have consistent low levels of groundwater contamination, including BTEX and chlorinated solvents, in the overburden aquifer system. The source of this contamination has not been specifically investigated or delineated.

The bedrock aquifer system, Area 3, between the Landfill's northern property boundary and School House Lane, appears to be most impacted on the northern part of the Site. Bedrock monitoring well D-2 appears to have the highest concentration of contaminants on and around the Landfill with consistent low level BTEX and elevated hits of chlorinated solvents. The source of this contamination has not been specifically investigated or delineated.

Within the well logs provided by the NJDEP is a Well Abandonment Report indicating that a well identified as D-2 was sealed on 2 February 1998. No Well Permit number is entered on the Report and, when the sketch of the location of the well sealed is compared to the Site drawing, it appears that the well sealed was in fact DW-2. Additionally, there are the analytical results from a well identified as D-2 for the years 1999, 2000 and 2001. For this Conceptual Approach, it is assumed

that the Well Abandonment Report is in error and that well location D-2 is still open and accessible while well location DW-2 is abandoned and sealed.

Area 4 consists of the groundwater and contaminant migration interaction between the overburden aquifer system of the Landfill and the other hydrologic regimes, such as the surface waters or bedrock aquifer, and encompasses Area 1, Area 2 and Area 3. These hydrologic interactions are poorly understood and need to be investigated to determine what role the Landfill has in contributing to the surrounding contamination of aquifers, springs and surface waters.

Regional bedrock groundwater is inferred to flow towards the Lammington River. The Lammington River, the most likely discharge point for the bedrock aquifer, is located north of the Site and flows southward – east of the Landfill. The source of the bedrock aquifer contamination is inferred to be overburden contamination that is migrating deeper, although the overburden and bedrock aquifer interactions are poorly understood at this point.

APPROACH

The following Approach has been developed from the current understanding of the project, presented above, including a review of the Revised Bedrock Aquifer Investigation Scope of Work Memorandum, prepared by the NJDEP and dated September 3, 2003. The primary objective of the remedial investigation is to address the following four areas and, from the results, evaluate the need for remediation of the bedrock aquifer –

Area 1 – Western part of the Landfill in the vicinity of MW-1,

Area 2 – Southern part of the Landfill in the vicinity of MW-6, and

Area 3 – Northeast of the Landfill between the Landfill edge and School House Lane.

Area 4 – Regional Groundwater Delineation and Interaction

It should be noted that Area 4, the Regional Groundwater Delineation and Interaction investigation, encompasses Area 1, Area 2 and Area 3 and is intended to address the overburden/bedrock aquifer interactions so that a better understanding of the potential human and ecological receptors can be assessed. To complete the objectives for the four areas, seven tasks have been identified:

- Geophysics – Areas 1, 2 and 3,
- Overburden Groundwater Delineation – Areas 1, 2 and 3,
- Groundwater Sampling – Area 4,
- Bedrock Aquifer Investigation – Area 4,
- Survey – Area 4,
- Model Preparation and Aquifer Testing – Area 4, and
- Report Preparation

The Geophysics task consist of both surficial and downhole components. The Overburden Groundwater Delineation will address two areas that historically have shown low level overburden groundwater contamination. Groundwater Sampling will show the current state of the overburden and bedrock aquifers as well as investigate the surrounding streams, seeps and springs that may be affected by the overburden or bedrock aquifer systems. The Bedrock Aquifer Investigation is planned to delineate the current extent of contamination in the bedrock aquifer. The Survey will provide an updated datum for the Site and surrounding stream, seep, spring and POET locations where available. The interaction between the overburden and bedrock aquifer systems, both groundwater flow and contaminant migration, will be investigated through the development of a numerical model and, as the model is developed, the need for additional aquifer testing will be considered. Finally, the findings from these tasks will be compiled into a Remedial Investigation Report that will provide an interpretation of the results and make appropriate recommendations for Remedial Actions. A preliminary schedule is provided as Figure 8.

All investigation and sampling activities will be performed in accordance with N.J.A.C. 7:26E; New Jersey Technical Requirements For Site Remediation (NJDEP, 1999), the New Jersey Field Sampling Procedures Manual (NJDEP, 1992) and, where applicable, other relevant regulation and guidance for conducting investigations at contaminated sites.

Geophysics

Surficial geophysics has proven useful in identifying potential water bearing bedrock fracture zones. Unfortunately the most useful methods, VLF and EM, are affected by high tension power lines such as the ones running through the Site. It is proposed that a pilot study with these two surficial geophysical field methods be conducted to determine the level of interference encountered and the usability of data collected from beneath these lines. In addition, it is proposed that several seismic lines be conducted during the pilot study and that the data collected be evaluated before proceeding with the complete geophysical program.

Area 1, 2 and 3 will require geophysical surveys in an attempt to identify subsurface features that would infer potential water bearing zones in the bedrock. Once the geophysical methods have been evaluated with respect to the specific Site conditions in each area, the appropriate method or methods should be implemented to assist in siting the proposed bedrock wells. It is anticipated that a combination of the three surficial geophysical methods will be found suitable for the unique Site conditions.

In Area 1 Berger proposes to conduct a Ground Penetrating Radar (GPR) Survey in the area where the historical pond was. Results from the GPR Survey would be used to confirm the location and extent of the former pond. Downhole geophysics, including natural gamma, electric (SP), caliper and fluid temperature/conductivity will be conducted on all permanent monitoring wells drilled

during this investigation as well as the existing deep wells with open borehole sections. An acoustic optical viewer will also be utilized to visualize the uncased portion of the deep wells. The information collected from these methods will be used to modify the existing conceptual bedrock model of groundwater flow between and within hydrologic regimes and would be useful in the development of a finite differences groundwater flow model.

Overburden Groundwater Delineation

Overburden groundwater delineation should be conducted in Area 1, Area 2 and Area3 as shown in Figure 4. Area 1 (Figure 5) and Area 2 (Figure 6) will each require three additional 4-inch overburden monitoring wells with maximum depths of approximately sixty feet below grade (fbg). Temporary well points will not allow adequate opportunity to delineate contaminant concentration and migration with respect to the seasonal fluctuations of the overburden groundwater surface. Continuous split spoon logging should be conducted at each boring location. The proposed well locations, in each Area, appear to be outside of the current Landfill property boundaries and as such will require access agreements for both well installation and periodic sampling.

In addition to these investigation activities, Berger proposes to investigate the location of the former pond in Area 1. The former location will be investigated with a GPR survey and, once the location is confirmed, a soil boring will be placed in the area. Continuous split spoon sampling will be conducted to bedrock. It is estimated that up to five soil samples will be collected from this boring location. All samples will be collected using the EnCore sampling procedure or equivalent and all samples will be analyzed for VOCs+10 with MTBE and TBA included. An overburden groundwater monitoring well will be emplaced to allow groundwater sample collection.

Area 3 (Figure 7) will require three initial 4-inch overburden groundwater wells with maximum depths of approximately sixty fbg. After the initial three wells have been installed and developed, groundwater samples will be collected and analyzed for VOC's +10 with MTBE and TBA included. Based upon the analytical results, up to five additional wells will be installed, developed and sampled. As a result of the activity identified in the historical aerial photos, it is recommended that continuous split spoon sampling be conducted to bedrock. Soil sampling should be conducted with an average of one sample for every ten feet of overburden (approximately 15 – 18 total soil samples) and all samples would be analyzed for VOCs+10 with MTBE and TBA included.

If, during the installation of the three initial wells, it is determined that direct push would be acceptable then temporary well points will be considered in lieu of additional permanent wells. If direct push is used then upon completion of the overburden delineation, two of the locations will be installed as permanent overburden wells. These wells, as part of the overburden monitoring well network, will allow continued monitoring of contaminant migration in the overburden. Continuous

split spoon logging should be conducted at each boring location. The proposed well locations are outside of the current Landfill property boundaries and will require access agreements for both well installation and periodic sampling.

Groundwater Sampling

The current status of groundwater contamination in the overburden and bedrock aquifers of Area 4 needs to be assessed. To accomplish the groundwater characterization and contaminant delineation, it is recommended that piezometers, surface waters, springs, monitoring wells and residential/POETS locations are sampled in an initial round. A minimum of two rounds of sampling will be conducted to allow a more comprehensive view of contamination in the varying hydrologic regimes. POETS sampling would be coordinated and conducted by the NJDEP

The initial event will consist of a reconnaissance of the surface water streams surrounding the Landfill and selection of appropriate surface water sampling locations. Seeps and springs will be marked on a field map and where possible, their proposed sampling coordinates will be identified using a GPS receiver. Following identification of suitable sampling locations, up to eight of the locations will be selected for sampling through use of Passive Diffusion Bag (PDB) samplers. The PDB samplers will be emplaced at the beginning of the round of sampling at the stream/seep/spring location. All PDB samplers will be emplaced for a minimum of 14 days to allow equilibration with the selected aquifer interval.. At the completion of the sampling round (14 to 21 days later) the PDB samplers will be recovered and equilibrated samples collected.

After the initial emplacement of the stream/seep/spring PDB samplers, a round of water level measurements and sampling of piezometers and monitoring wells will commence. Water level measurements will include sounding the wells to confirm total depth of wells. It is proposed that vertical delineation of contaminants, for the wells associated with the Landfill, be conducted using PDB samplers. Many of the existing overburden and bedrock wells have varying screen lengths or open boreholes of up to 70 feet. The use of PDB samplers will allow better delineation of the vertical extent of contamination. All PDB samplers will be emplaced for a minimum of 14 days to allow equilibration with the selected aquifer interval. The initial delineation effort will require approximately 135 PDB samplers for stream/seep/spring and well sampling including the required QA/QC samples. Groundwater samples, including the stream/seep/spring samples, will be analyzed for VOC's +10 with MTBE and TBA included. Specific sample locations, as presented in Table 2, include shallow, intermediate and deep zones broadly distributed across the Landfill and include the nine proposed overburden delineation wells for Area 1, Area 2 and Area 3. The number of intervals is based on the amount of open borehole or screened interval at each location.

The Landfill is known to have accepted Pharmaceutical waste products in the past. The cost for VOCs analyses specific to the Pharmaceutical Industry by Isotope Dilution GC/MS Revision A, July

1998 (Method 1666) is expensive to run and does not seem to provide any extra benefit to assessing the existing contamination. However, if requested, selected wells could be purged using a low flow methodology and samples collected for analysis using Method 1666.

The second round of groundwater sampling will employ fewer PDB samplers and will be targeted on specific locations and intervals based on the analytical results of the initial sampling round. It is proposed that the second round of groundwater sampling be conducted following completion of the other investigative activities so that any additional well location can be included at that time. For planning purposes it is estimated that the second round of sampling will require 100 PDB samplers for stream/seep/spring and well sampling.

Bedrock Aquifer Investigation

Ten bedrock wells are proposed for the Combe South Landfill. All of the wells will initially be drilled through the overburden and completed at 200 feet into the bedrock. Of the ten proposed wells, three bedrock wells (Figure 4, Figure 5) are proposed to address potential contaminant migration issues for Area 1 and Area 2. One of the ten bedrock wells will be installed as a replacement for the existing D-4 which will be abandoned during this field effort. The remaining seven deep wells will be placed to delineate the vertical and horizontal extent of contamination migration. Proposed well locations for Area 3 are illustrated in Figure 6. All newly installed wells will be examined using a variety of downhole geophysical methods as previously described in the Geophysics section above.

The focus of this investigation is to determine to what extent, if any, remediation of the bedrock aquifer is required. Typical bedrock aquifer investigations rely on nested deep monitoring wells supplemented with packer testing of selected zones based on interpreted results of downhole geophysical methods. Packer testing is either done at predetermined intervals as the deep hole is advanced to its target depth or, alternately, the deep monitoring well is drilled to the target depth and packer testing of specific zones commences after completion. As an alternative to the traditional packer tests, Berger proposes that the FLUTe™ Liner technique, including use of a Multiport Liner, be implemented for all on-site bedrock wells.

There are no changes in the well construction details for the FLUTe™ Liner system. Well construction will require a standard 10-inch borehole advanced through the overburden and ten feet into bedrock at which point a 6-inch steel casing will be grouted in to place. After allowing the grout to set overnight, a six-inch borehole will be advanced through the steel casing to the target depth of 200 feet into the bedrock. Once the borehole is complete, a FLUTe™ Liner will be everted to seal the available flow paths. There is a relationship between the rate of descent of the liner and the remaining flow paths between the advancing liner and the bottom of the borehole. This relationship is measurable and can be used to identify aquifer zones of high flow which correspond to fractures

or other highly permeable regions. Once everted, the borehole is effectively sealed so that there is no migration of contaminants from one region of the aquifer to another. The liner can be retracted and everted multiple times as necessary, allowing the borehole to be logged with downhole geophysical methods as they are available – with minimal contaminant migration. Once the high permeable zones are identified, Multiport Liners can be ordered and installed. With the Multiport Liners, groundwater can be gauged and sampled quickly and easily, and the liner effectively seals all other regions of the aquifer. Additionally, by using the Multiport Liner there is no need to grout boreholes that have been overdrilled. The Multiport Liner seals off overdrilled zones from the rest of the aquifer preventing contaminant migration.

Survey

A regional aerial survey will be completed and will encompass the area bounded by Parker Road to the East, Old Route 24 and Mill Road to the North, East Valley Brook Road to the West and Old Farmers Road to the South as shown in Figure 9.

Additionally, in order to plot the vertical and horizontal locations of all sampling points, groundwater levels, surface water levels, and any other pertinent Site features on a single, accurate Site plan, a ground survey will be conducted at the outset, and at the completion, of RI field investigations. Locations of springs, groundwater screening locations, product delineation locations, monitoring wells, and surface water and spring sample locations will be surveyed for horizontal and vertical location.

A New Jersey licensed surveyor will be contracted to survey and map the Site and sampling points. The survey will include the production of a single topographic Site map depicting the Site and study area. All horizontal data on the Site map will be plotted in the New Jersey State Plane Coordinate System (NAD83), and topographic contours and spot elevations shown in the North American Geodetic Vertical Datum (NAGVD88). Mapping shall adhere to standards described in the NJDEP document *Geographic Information System Digital Data Standards* and include the requirements set forth in the *New Jersey State Board of Professional Engineers and Land Surveyors Administrative Rules and Regulations*. The topographic Site map will include the following pertinent topographic and structural features for all properties surveyed:

- topography represented with 2-foot elevation contour intervals and spot elevations;
- locations of all existing buildings/permanent structures, adjacent roadways, streams and springs and elevations of all stream gauges,
- the full current property boundary lines of the Site and adjacent properties; and;
- locations and elevations of all monitoring wells.

Model Preparation and Aquifer Testing

The existing geologic, hydrogeologic and analytical data will be evaluated and incorporated into a finite differences model that will be used to evaluate groundwater flow using MODFLOW as well as contaminant transport using MT3D. The regional model boundaries will extend from Tanners Brook to the Northwest, Lammington River to the Northeast and Southeast and Rinehart Brook to the Southwest and will incorporate both the overburden and bedrock flow conditions. Local model boundaries will encompass the entire landfill including a 1,000 foot buffer to the Northwest, Southwest and Southeast as well as to Old Route 24 towards the Northwest.

The groundwater flow and contaminant transport model will be developed using the Department of Defense *Groundwater Modeling System* (GMS), a comprehensive graphical user environment for performing groundwater simulations. The GMS package consists of a graphical user interface that incorporates a number of analysis codes, including MODFLOW, MT3D, RT3D, etc. The GMS interface was developed by *Environmental Modeling Research Laboratory* (formerly *Engineering Computer Graphics Laboratory*) of Brigham Young University, in partnership with the United States Army Engineers Waterways Experiment Station. The USGS modular groundwater flow model, MODFLOW, is a block-centered, finite difference numerical package capable of simulating 3-dimensional steady state or transient saturated flow.

MT3D is a modular three-dimensional transport model for simulation of advection, dispersion and chemical reactions (including biodegradation) of dissolved constituents in groundwater systems. It was designed in such a way that it can be used in conjunction with MODFLOW. As a result, MT3D has often been selected as the transport model when MODFLOW is used for flow simulation. In addition, MT3D is one of the most comprehensive transport packages available on the market. Applications of this model include, but are not limited to, plume size estimation and cleanup time estimation. MT3D within the GMS package can be used for contaminant transport calculations and plume migration simulation. A detailed mathematical description of this model can be found in an EPA document prepared by Zheng 1990.

Once the model is developed it will be calibrated and verified using the existing groundwater elevation and contaminant concentration data. The need for additional Aquifer testing, to clarify the flow or transport conditions in a particular region of the local modeled area, will be assessed during the model calibration and verification process.

Report Preparation

Following the implementation and completion of all activities included in this Conceptual Approach, a RI report will be drafted and submitted for review. The report will conform to the requirements

for Site Investigation Reports and Remedial Investigation Reports as specified in NJAC 7:26E et. seq. Typically, these reports include the following elements at a minimum:

- a description of all investigative activities performed;
- compilation and analysis of all derived investigative data;
- conclusions drawn from the data analysis; and
- recommendations for any further remedial investigations or remedial actions if warranted.

To expedite the preparation and review of the Draft Site Sampling and Investigation Plan (SSIP), a working meeting should be held to discuss the ideas presented in this letter, the various interpretations of the site conditions, and the potential approaches to the investigation prior to completion of the Draft SSIP. Please contact Mike McCloskey at (973) 765-1910 (e-mail mmcclosk@louisberger.com), Jeff Farrell at (973) 765-1807 (e-mail jfarrell@louisberger.com), or Rich Harding at (973) 765- 1811 (e-mail rharding@louisberger.com) at your earliest convenience to discuss a meeting schedule.

Sincerely,

THE LOUIS BERGER GROUP, INC.

Thomas G. Lewis, P.E., J.D.
Program Manager

cc: K. Petrone, G. Giles, J. Robbins (NJDEP); P.Baxter (EPA)
M. McCloskey, R. Harding, J. Farrell (Berger)
Attachment

TABLES

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX AA (Page 1 of 6)

ANNOTATED SITE CHRONOLOGY

Combe Fill South Landfill[a]
(Excluding related sampling events)[b]

DATE	EVENT
1940s	Small fill operation owned and operated by Filiberto family.
1970-1971	Landfill operated by Filiberto Sanitation, Incorporated.
Jul 1972	Fish kill in Trout Brook prompts Division of Fish and Game to request geologic investigation.
12 Dec 1972	"Certificate of Registration" issued to Chester Hills Incorporated for sanitary landfill operation on Parker Road in Chester Township.
Feb 1973	Analyses by Washington Township completed for samples of 2 springs on resident No. 51 property.
18 Mar 1973	Inspection of Trout Brook to landfill by Chester officials leading to letter requesting action on part of New Jersey Department of Environmental Protection (NJDEP) to stop pollution of brook.
29 May 1973	Investigation of Trout Brook headwaters by NJDEP.
23 Jul 1973	Site inspection by NJDEP and Chester Township of Trout Brook and resident No. 51 well. High bacterial counts were found in Trout Brook leading to recommendations for additional leachate treatment and recycling.
Jul 1973	Chester Hills, Incorporated installs leachate collection and recirculation system.
6 Aug 1974	NJDEP proposes locations of first four monitoring wells.

[a]Revisions and updates made to original chronology presented in RAMP.
[b]Summary of sampling events in association with the landfill are summarized in Appendix BB.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX AA (Page 2 of 6)

ANNOTATED SITE CHRONOLOGY

Combe Fill South Landfill[a]
(Excluding related sampling events)[b]

DATE	EVENT
1976	Leachate collection and pumping system becomes inactive.
1977	After much discussion, Chester Hills installs two observation wells.
27 Jan 1977	Chester Hills begins sampling of site monitoring wells for metals, phenols, cyanide, and conventional sanitary constituents; sampling continues every few months until May 1981 with some changes in sample location/designation.
5 Sep 1978	Combe Fill, Incorporated submits "Application of Notification of Change in Ownership" to Solid Waste Administration.
15 Jan 1979	Sparks from operating doser ignite aerosol cans of hairspray, resulting in explosions and small fires.
26 Sep 1979	Combe Fill Corporation cited for exceeding maximum allowable width of operating face, for inadequate daily cover, and for excavation of previously deposited refuse at Combe Fill South Landfill.
12 May 1980	Chester Township files civil complaint against Combe Fill Corporation seeking to stop construction of a new access road. Judge Reginald Stanton issues restraining order against use of road.
Dec 1980	Local citizens discover clearing of trees in preparation for filling in wetland area to west of site.
1981	Chester Township Health Department steps up surveillance of landfill activities.

[a]Revisions and updates made to original chronology presented in RAMP.
[b]Summary of sampling events in association with the landfill are summarized in Appendix BB.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX AA (Page 3 of 6)

ANNOTATED SITE CHRONOLOGY

Combe Fill South Landfill[a]
(Excluding related sampling events)[b]

DATE	EVENT
31 Jan 1981	Combe Fill North Landfill closes, increasing truck traffic and aggravating problems at Combe Fill South Landfill.
6-19 Feb 1981	Local citizens, township leaders, and environmental activist groups file protest with NJDEP director because of Combe Fill Corporation's activities in the wetland.
23 Feb 1981	Chester and Washington Townships seek injunction against Combe Fill Corporation in Superior Court to prevent company from advancing fill into wetland area. Judge Stanton orders Combe Fill to halt wetland operations for two weeks.
8 Mar 1981	Court reverses restraining order and permits clearing of wetland and other preparations but prohibits waste disposal in wetland for 30 days.
19 Mar 1981	NJDEP issues an "Order Modifying Registration" requiring the suspension of operations in the wetland until Combe Fill Corporation submits a revised design showing use of clean fill in the wetland, leachate collection systems, impermeable barriers, and additional monitoring wells that would provide for secure disposal.
19 Mar 1981	U.S. Environmental Protection Agency issues citation to Combe Fill Corporation for violation of Section 301(a) of the Clean Water Act, orders them to cease wetland activities, and requires them to obtain a Section 404 permit.
24 Mar 1981	In a final ruling Judge Stanton orders that: (1) NJDEP designate areas suitable for fill

[a]Revisions and updates made to original chronology presented in RAMP.
[b]Summary of sampling events in association with the landfill are summarized in Appendix BB.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX AA (Page 4 of 6)

ANNOTATED SITE CHRONOLOGY

Combe Fill South Landfill[a]
(Excluding related sampling events)[b]

DATE	EVENT
	(2) Sediment erosion permits under CWA are not applicable
	(3) NJDEP appoint an impartial project manager to oversee problems and complaints
	(4) NJDEP and Combe Fill Corporation decide whether wetland dumping is permissible
10 May 1981	Combe Fill Corporation cited for failure to control littering, for improper grading, and for insufficient thickness of daily cover at Combe Fill South.
15 May 1981	NJDEP sets forth procedures for delineating wetland at site.
22 May 1981	Last recorded sampling and analyses of monitoring wells on site by Combe Fill Corporation.
8 Jun 1981	Combe Fill Corporation cited for failure to control littering and for inadequate daily cover at Combe Fill South Landfill.
28 Jul 1981	Combe Fill Corporation cited for inadequate cover at Combe Fill South.
17 Aug 1981	Combe Fill Corporation attorneys announce rate increase hearings with NJPUC scheduled for 18-21 August and 8-10 September 1981.
18 Sep 1981	Based on groundwater sampling on and around Combe Fill South Landfill, NJDEP issues a second "Order Modifying Registration" stating that groundwater contamination exists at the landfill and is likely to contaminate local water supplies. NJDEP orders that:

[a]Revisions and updates made to original chronology presented in RAMP.
[b]Summary of sampling events in association with the landfill are summarized in Appendix BB.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX AA (Page 5 of 6)

ANNOTATED SITE CHRONOLOGY

Combe Fill South Landfill[a]
(Excluding related sampling events)[b]

DATE	EVENT
	(1) Combe Fill Corporation submit revised engineering design including plan for proper closure and groundwater monitoring
	(2) Combe Fill South Landfill operation cease acceptance of all waste upon filling to elevations as marked by SWMA
	(3) Combe Fill Corporation ensure that revised design meets requirements of revised Solid Waste Management Act
Sep to Oct 1981	Strong winds limit acceptance of waste at Combe Fill South Landfill.
Oct 1981	Combe Fill Corporation officially declares bankruptcy and ceases acceptance of waste. Chester Township and NJDEP official temporarily assume responsibility of landfill. Landfill technically open.
13 Oct 1981	Combe Fill South cited for failure to apply adequate cover.
30 Nov 1981	Official closure of Combe Fill South.
18 Dec 1981	Combe Fill South cited for failure to limit size of working face, failure to control littering, and failure to apply adequate cover.
10 May 1982	Combe Fill South cited for failure to control litter and failure to apply final cover.
29 Jun 1982	Geologic reconnaissance at Combe Fill South.
Aug 1982	Terrain conductivity investigation at Combe Fill South.

[a]Revisions and updates made to original chronology presented in RAMP.
[b]Summary of sampling events in association with the landfill are summarized in Appendix BB.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX AA (Page 6 of 6)

ANNOTATED SITE CHRONOLOGY

Combe Fill South Landfill[a]
(Excluding related sampling events)[b]

DATE	EVENT
12 Aug 1982	Mitre Ranking Form submitted by NJDEP to U.S. EPA.
20 Dec 1982	Combe Fill South proposed for inclusion on National Priorities List (Superfund Sites)
22 Dec 1982	Combe Fill Corporation bankruptcy hearing.
8 Sep 1983	Combe Fill South on the National Priorities List.
Dec 1983	Remedial Action Master Plan (RAMP) prepared for Combe Fill South.
Jul 1984	NJDEP awards remedial investigation/feasibility study (RI/FS) contract to consultant.
Sep 1984 to Jan 1985	Borings made on site and new monitoring wells installed as part of RI/FS.
Apr 1985 to Nov 1985	On-site environmental monitoring conducted and analyses performed as part of RI/FS.

[a]Revisions and updates made to original chronology presented in RAMP.
[b]Summary of sampling events in association with the landfill are summarized in Appendix BB.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX BB (Page 1 of 4)

CHRONOLOGY OF ENVIRONMENTAL SAMPLING IN AND AROUND SITE

Combe Fill South Landfill[a,b]

DATE	SAMPLER	SAMPLED MEDIA	ANALYSES CONDUCTED
15 Nov 1973	NJDEP	Residential wells and surface waters (Trout Brook)	Metals, conventional pollutants[c], phenols, and cyanide for surface water
26 Jul 1974	NJDOH	Surface waters (tributaries and ponds)	(Unknown - data not available)
8 Aug 1980	Washington Township	Surface waters (Trout Brook)	Metals, phenols, cyanide
10 Sep 1980	Chester Health Dept.	Combe monitoring wells	Metals
16 Oct 1980	Washington Township	Surface waters (Trout Brook)	Metals, coliform
28 Oct 1980	Borough of Madison	Residential wells	Metals, coliform, pH
6 Jan 1981	NJDEP	Combe monitoring wells	Metals
2 Feb 1981	Chester Health Dept.	Residential wells	Metals

[a]Excluding sampling by Chester Hills Corp. and Combe Fill Corp., operators of site.
[b]Excluding sampling associated with Remedial Investigation (see Chapter 1 of main text for this information).
[c]Conventional pollutants may include BOD_5, total suspended solids, COD, total organic carbon, etc.
[d]VOA = Volatile organics.
Acid = Acid extractable organics.
B/N = Base/neutral extractable organics.
Full PP = All priority pollutants.
PCB = Polychlorinated biphenyls.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX BB (Page 2 of 4)

CHRONOLOGY OF ENVIRONMENTAL SAMPLING IN AND AROUND SITE

Combe Fill South Landfill[a,b]

DATE	SAMPLER	SAMPLED MEDIA	ANALYSES CONDUCTED
3 Mar 1981	NJDEP	Surface waters leachate, and monitoring wells	VOA, B/N, metals, cyanide, conventional pollutants
3 Mar 1981	Borough of Madison	Residential wells	Metals, pH
23 Mar 1981	URWA	Surface waters/ leachate, Combe monitoring wells	Full PP, conventional pollutants, radio-activity
24-28 Mar 1981	Chester Health Dept.	Residential wells	Metals
28-30 Apr 1981	NJDEP	Surface water	Full PP
6 May 1981	NJDEP	Combe monitoring wells; residential wells	Metals, cyanide
28 May 1981	HALT	Residential wells	VOA, manganese
8-22 Jun 1981	HALT	Residential wells	VOA
12 Jun 1981	NJDEP	Residential wells	Acid, B/N, pesti-cides, PCB, metals, phenol, cyanide, chloride

[a]Excluding sampling by Chester Hills Corp. and Combe Fill Corp., operators of site.
[b]Excluding sampling associated with Remedial Investigation (see Chapter 1 of main text for this information).
[c]Conventional pollutants may include BOD_5, total suspended solids, COD, total organic carbon, etc.
[d]VOA = Volatile organics.
Acid = Acid extractable organics.
B/N = Base/neutral extractable organics.
Full PP = All priority pollutants.
PCB = Polychlorinated biphenyls.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX BB (Page 3 of 4)

CHRONOLOGY OF ENVIRONMENTAL SAMPLING IN AND AROUND SITE

Combe Fill South Landfill[a,b]

DATE	SAMPLER	SAMPLED MEDIA	ANALYSES CONDUCTED
12 Jun 1981	Jason Cotrell & Assoc.	Residential wells	Acid, B/N, pesticides, PCB, metals, phenol, cyanide, chloride
7 Jul 1981	Chester Health Dept.	Residential wells	Metals
10 Jul 1981	Chester Estates	Residential wells	Conventional pollutants
17 Jul 1981	NJDEP	Residential wells	VOA
28 Jul 1981	Chester Health Dept.	Residential wells	Conventional pollutants
1 Aug 1981	Chester Health Dept.	Residential wells	Heptachlor, heptachlor epoxide
9 Aug 1981	Townly Research (for Chester Health Dept.)	Residential wells	VOA
25 Aug 1981	Borough of Madison	Surface waters	Tannins
11 Sep 1981	Chester Health Dept.	Residential wells	Selenium
24 Sep 1981	NJDEP	Residential wells	Lead

[a]Excluding sampling by Chester Hills Corp. and Combe Fill Corp., operators of site.
[b]Excluding sampling associated with Remedial Investigation (see Chapter 1 of main text for this information).
[c]Conventional pollutants may include BOD_5, total suspended solids, COD, total organic carbon, etc.
[d]VOA = Volatile organics.
Acid = Acid extractable organics.
B/N = Base/neutral extractable organics.
Full PP = All priority pollutants.
PCB = Polychlorinated biphenyls.

TABLE 1: Extracted Chronology of Events – Combe Fill South Landfill

APPENDIX BB (Page 4 of 4)

CHRONOLOGY OF ENVIRONMENTAL SAMPLING IN AND AROUND SITE

Combe Fill South Landfill[a,b]

DATE	SAMPLER	SAMPLED MEDIA	ANALYSES CONDUCTED
8 Jun 1982	NJDEP	Residential wells with water filters	Conventional pollutants, metals, phenol, cyanide
16 Mar 1983	Chester Health Dept.	Leachate	VOA, metals, conventional pollutants
3 Feb 1984	NJDEP	Surface waters, residential wells	Full PP
9 Feb 1984	NJDEP	Surface waters	Full PP
16 Mar 1984	Borough of Madison	Residential wells	VOA
13 Apr 1984	NJDEP	Residential wells	Full PP
17 Jul 1984	Borough of Madison	Residential wells	VOA
21 Mar 1985	NJDEP	Residential wells, surface waters	Full PP

[a]Excluding sampling by Chester Hills Corp. and Combe Fill Corp., operators of site.
[b]Excluding sampling associated with Remedial Investigation (see Chapter 1 of of main text for this information).
[c]Conventional pollutants may include BOD_5, total suspended solids, COD, total organic carbon, etc.
[d]VOA = Volatile organics.
Acid = Acid extractable organics.
B/N = Base/neutral extractable organics.
Full PP = All priority pollutants.
PCB = Polychlorinated biphenyls.

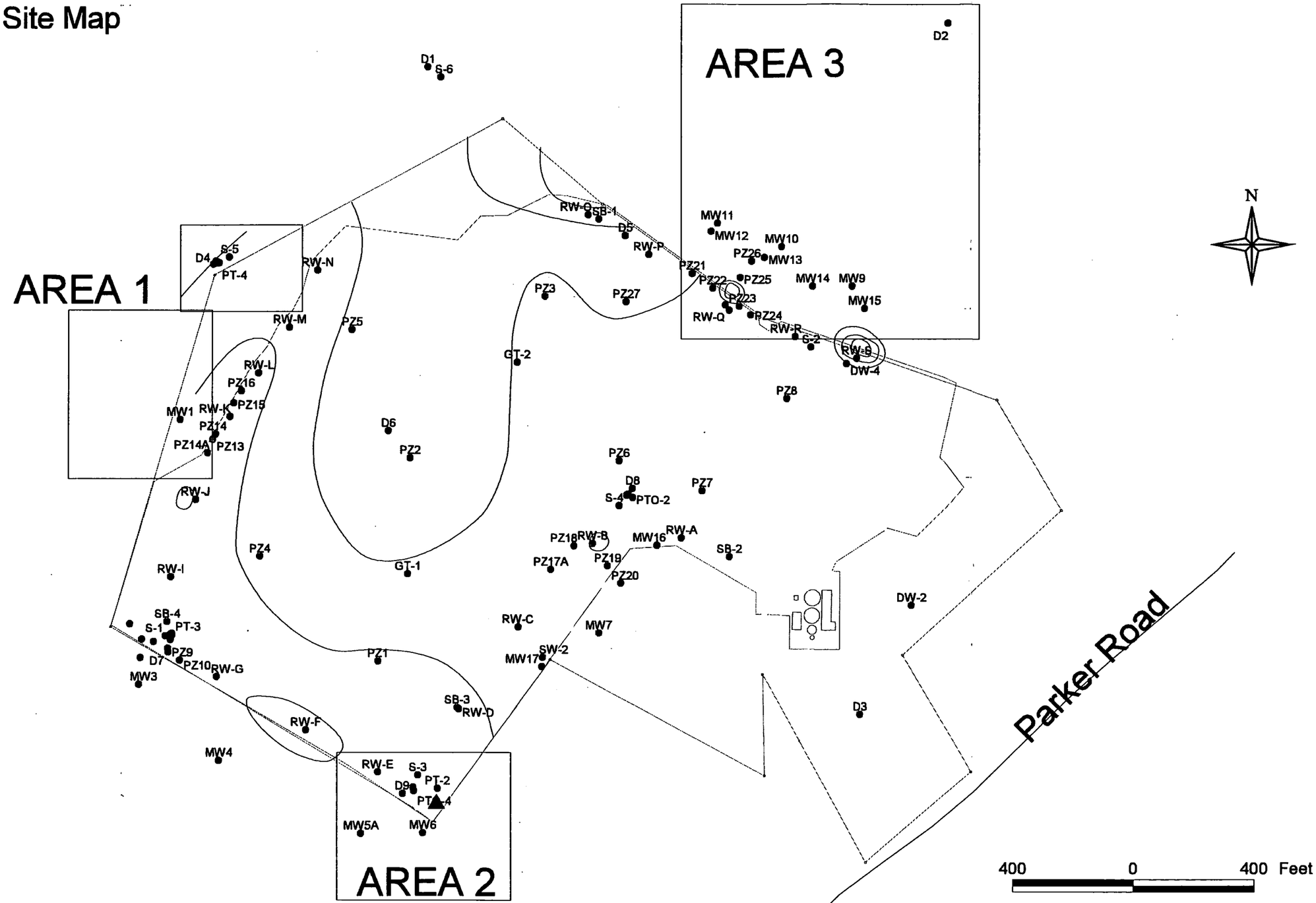
Table 2 – Proposed PDB Sampler Locations And Number Of Intervals Monitored Per Location

Piezometer / Well ID	Number of PDB Intervals	Piezometer / Well ID	Number of PDB Intervals	Piezometer / Well ID	Number of PDB Intervals
MW-1	1	D-5	4	PZ-22	2
MW-2	1	D-6	5	PZ-23	1
MW-3	1	D-7	1	PZ-24	2
MW-4	1	D-8	3	PZ-25	2
MW-5A	2	D-9	2	PZ-26	2
MW-6	2	PZ-3	3	PZ-27	2
MW-7	1	PZ-6	2	S-1	1
MW-8A	2	PZ-7	2	S-2	2
MW-9	1	PZ-8	2	S-3	2
MW-10	2	PZ-9	1	S-4	2
MW-11	2	PZ-10	1	S-5	1
MW-12	2	PZ-11	1	S-6	2
MW-13	2	PZ-12	1	New well 1A	1
MW-14	2	PZ-13	1	New well 1B	1
MW-15	2	PZ-15	2	New well 1C	1
MW-16	3	PZ-16	2	New well 2A	1
MW-17	2	PZ-17	1	New well 2B	1
D-1	3	PZ-18	2	New well 2C	1
D-2	6	PZ-19	2	New well 3A	1
D-3	3	PZ-20	1	New well 3B	1
D-4	3	PZ-21	1	New well 3C	1
TOTALS	44		40		30

FIGURES

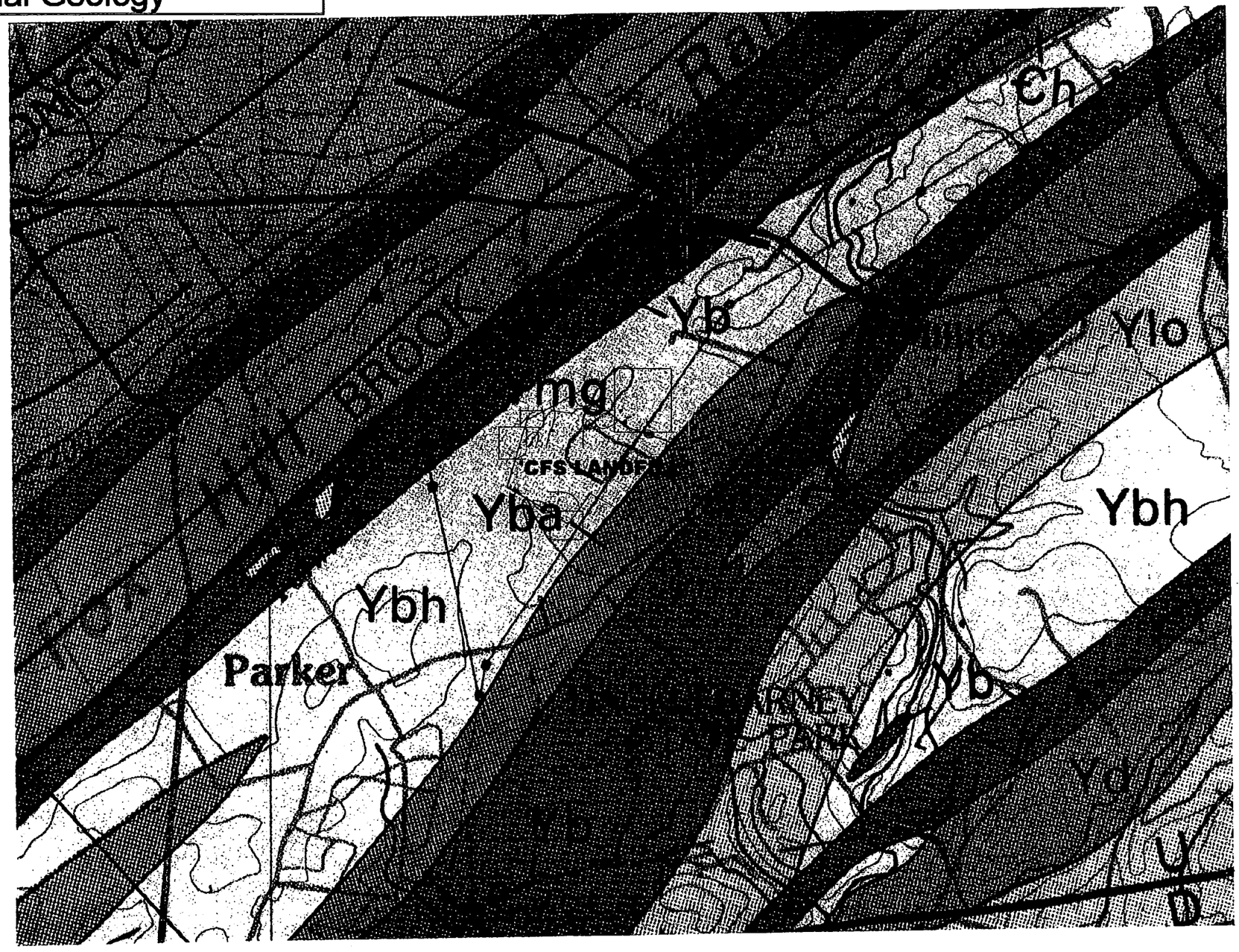
Combe Fill South Landfill

Figure 1 - Site Map



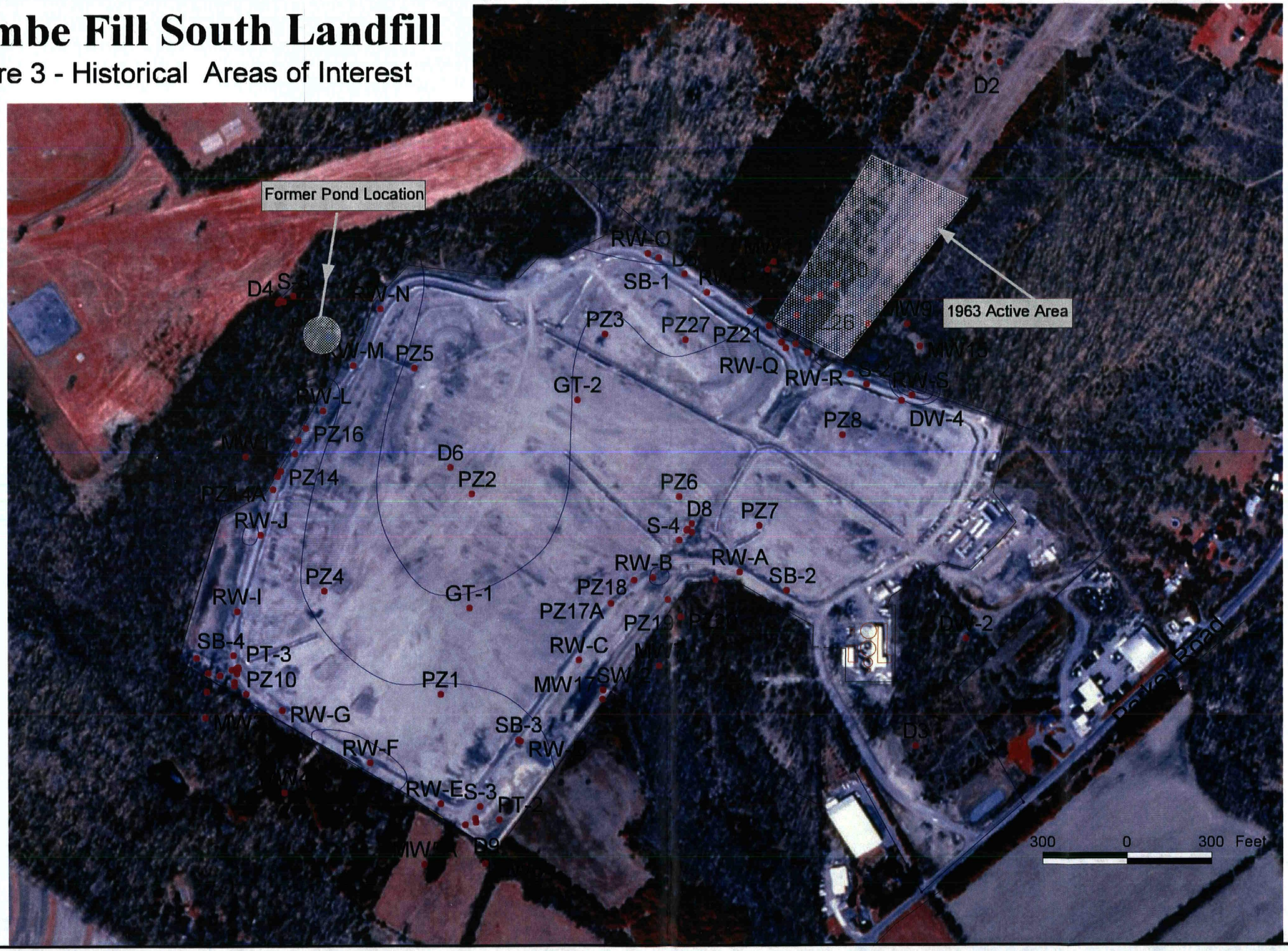
Combe Fill South Landfill

Figure 2 - Regional Geology



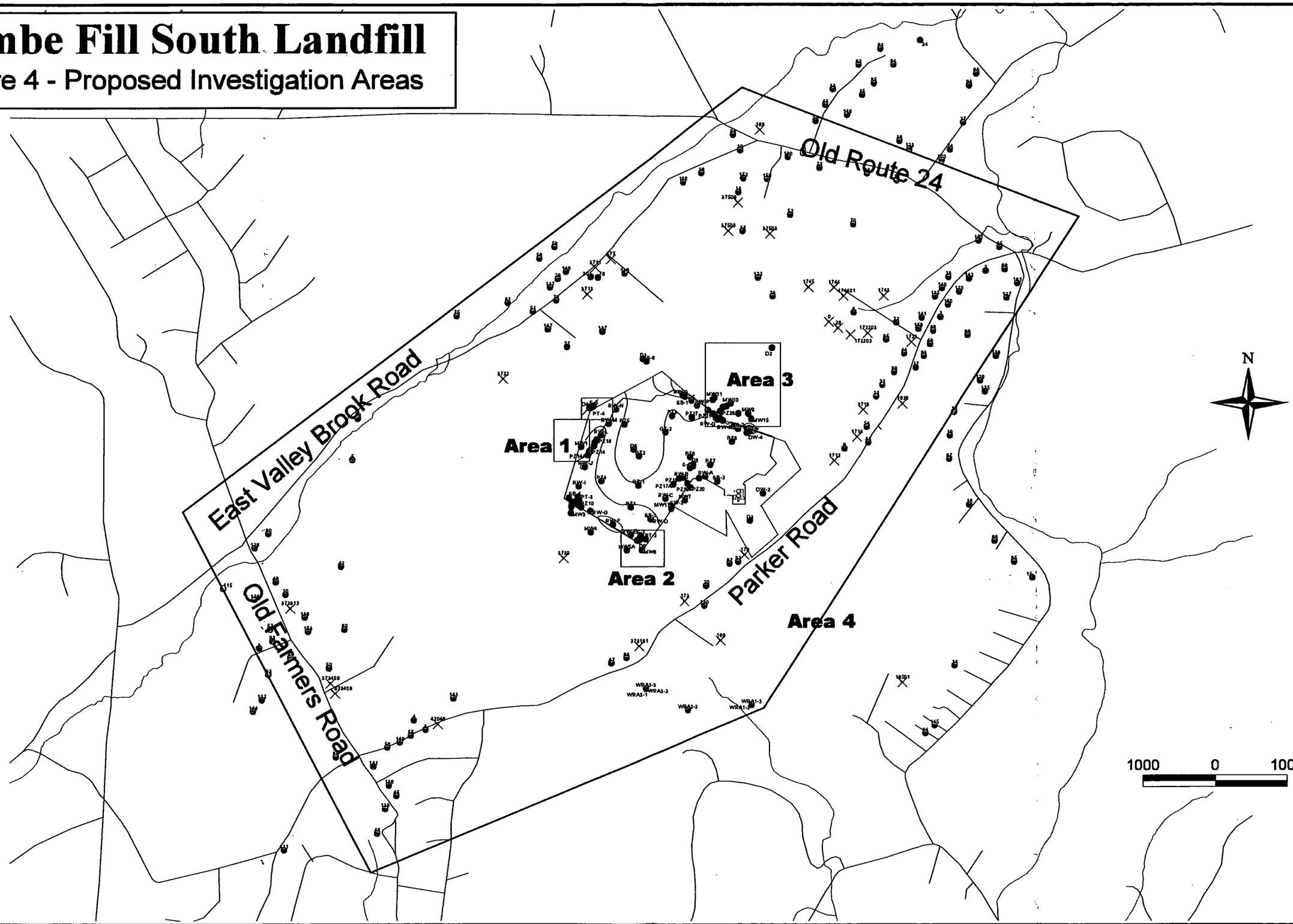
Combe Fill South Landfill

Figure 3 - Historical Areas of Interest



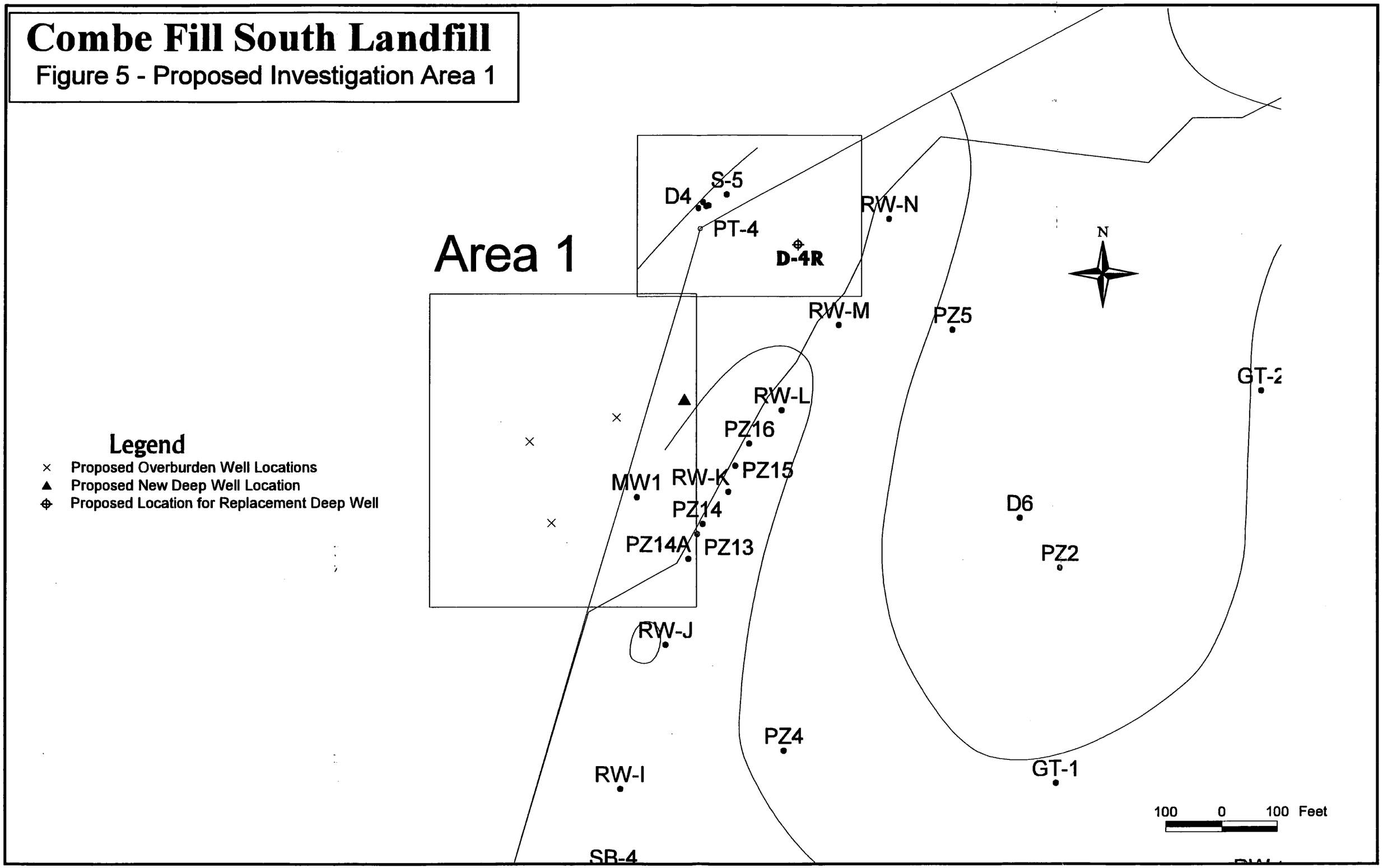
Combe Fill South Landfill

Figure 4 - Proposed Investigation Areas



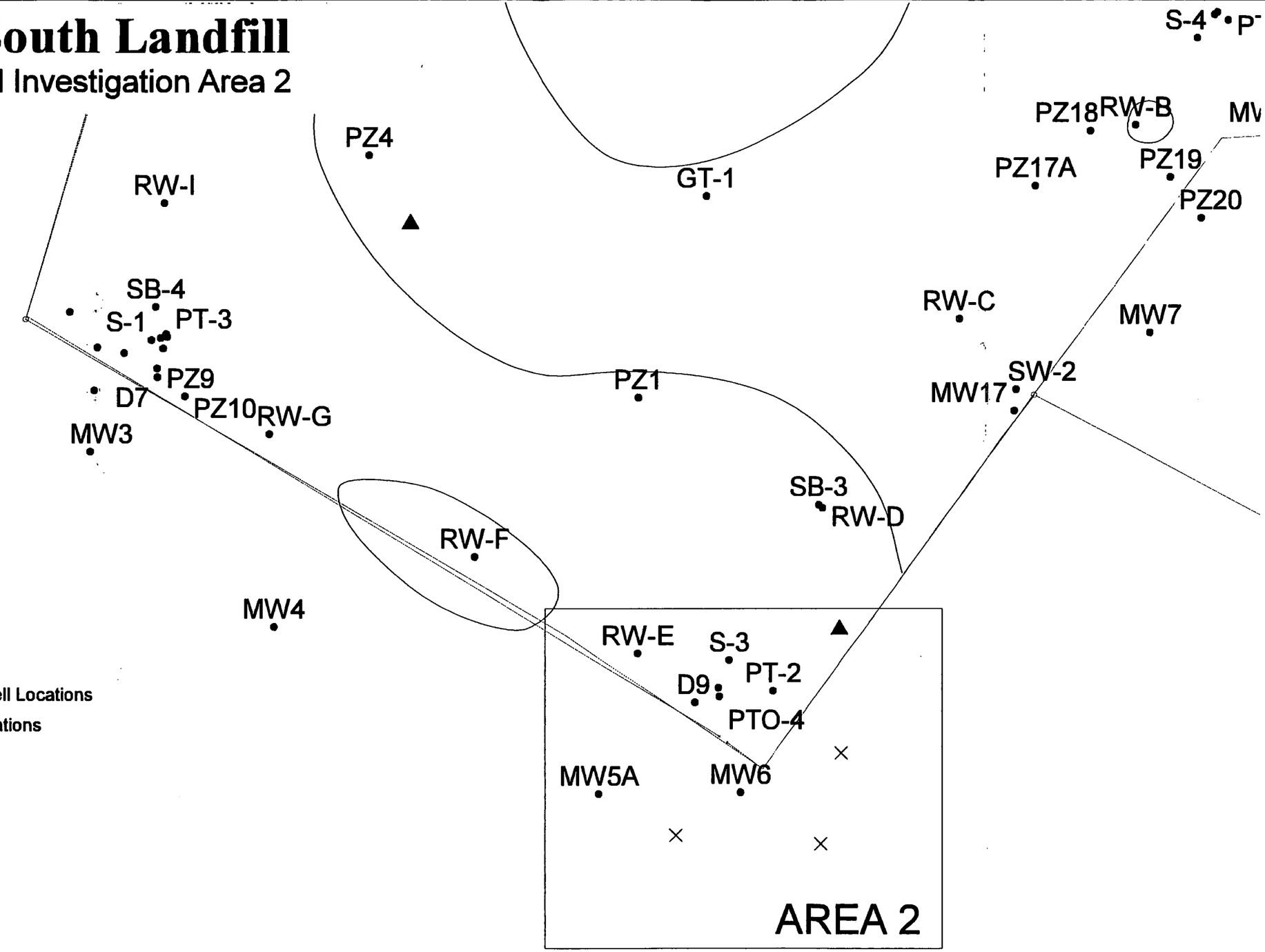
Combe Fill South Landfill

Figure 5 - Proposed Investigation Area 1



Combe Fill South Landfill

Figure 6 - Proposed Investigation Area 2



× Proposed Overburden Well Locations

▲ Proposed Deep Well Locations

N

200 0 200 Feet

Combe Fill South Landfill

Figure 7 - Proposed Investigation Area 3

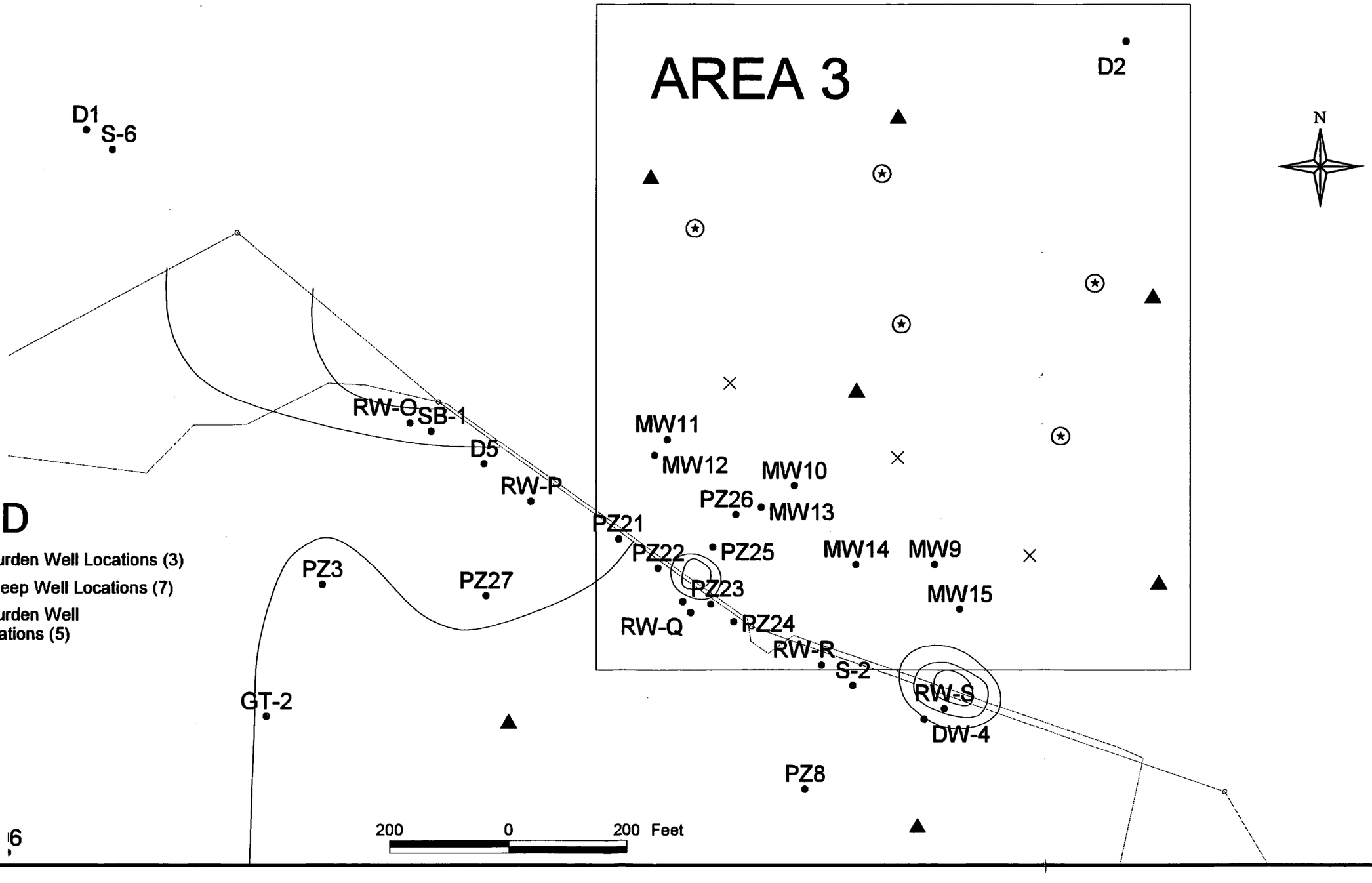
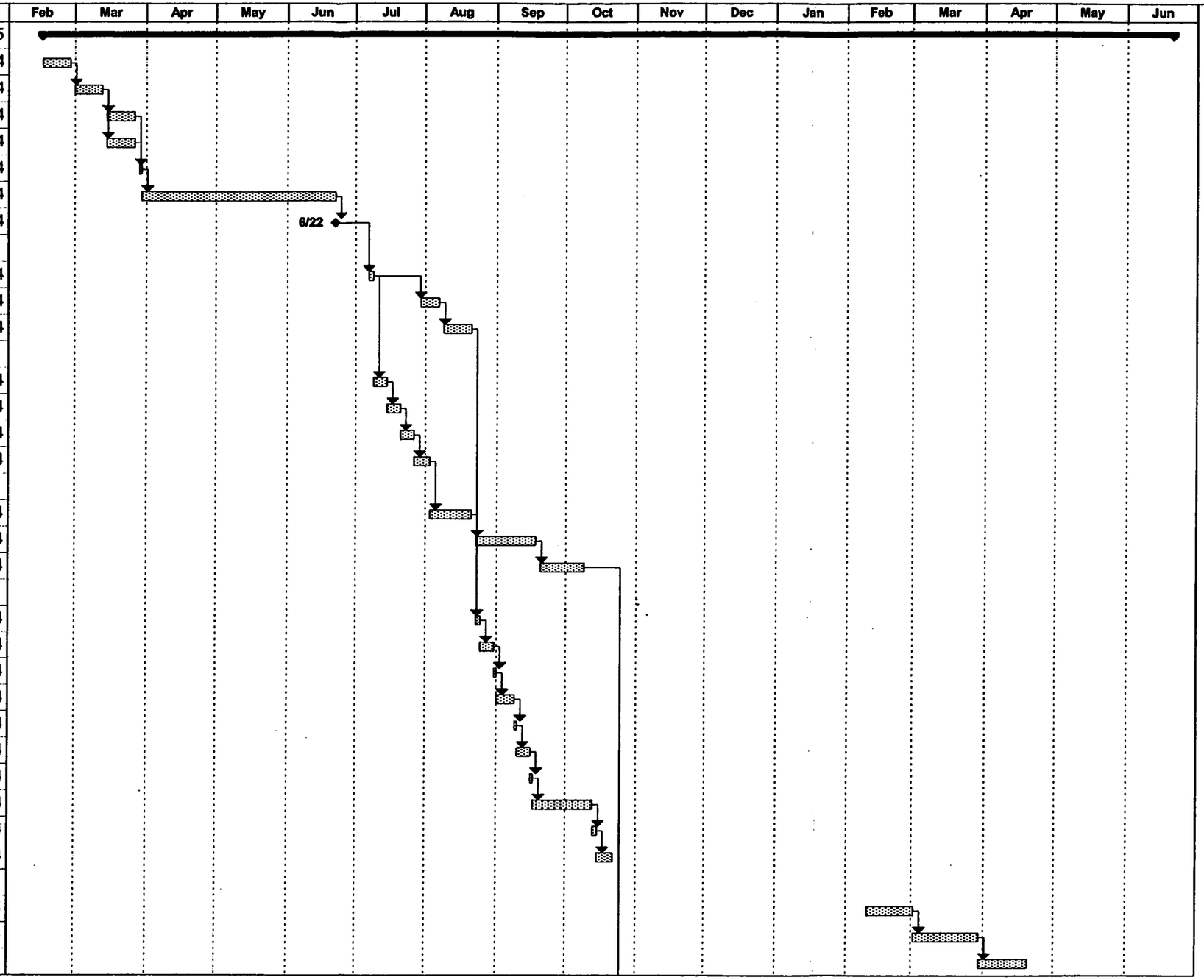


FIGURE 8 - Preliminary Schedule - Combe Fill South Landfill Remedial Investigation

ID	Task Name	Start	Finish
1	COMBE FILL SOUTH LANDFILL	2/16/04	6/20/05
2	Peparation of DRAFT SSIP	2/16/04	2/27/04
3	NJDEP Review	3/1/04	3/12/04
4	Preparation of Final SSIP	3/15/04	3/26/04
5	Preparation of IFBs	3/15/04	3/26/04
6	Submission of SSIP/IFBs	3/29/04	3/29/04
7	NJDEP Review of IFBs	3/30/04	6/21/04
8	Engagement 2 Purchase/Change Orders	6/22/04	6/22/04
9			
10	Geophysical Pilot Study	7/7/04	7/8/04
11	Geophysical Surficial Survey	7/30/04	8/6/04
12	Data Analysis and Interpretation	8/9/04	8/20/04
13			
14	Installation of Area 1 Shallow Wells	7/9/04	7/14/04
15	Installation of Area 2 Shallow Wells	7/15/04	7/20/04
16	Installation of Area 3 Shallow Wells	7/21/04	7/26/04
17	Installation of three Soil Borings - Area 3	7/27/04	8/2/04
18			
19	Semi-Annual Groundwater Sampling (1st Round)	8/3/04	8/20/04
20	Laboratory Analysis	8/23/04	9/17/04
21	Data Analysis - Groundwater Samples	9/20/04	10/8/04
22			
23	Investigation of Former Pond - Area 1	8/23/04	8/24/04
24	Installation of Area 1 Deep Well	8/25/04	8/30/04
25	Multiport Liner Installation	8/31/04	8/31/04
26	Abandonment and Reinstallation of D4	9/1/04	9/8/04
27	Multiport Liner Installation	9/9/04	9/9/04
28	Installation of Area 2 Deep Well	9/10/04	9/15/04
29	Multiport Liner Installation	9/16/04	9/16/04
30	Installation of three Area 3 Deep Wells	9/17/04	10/12/04
31	Multiport Liner Installation	10/13/04	10/14/04
32	Downhole Geophysics	10/15/04	10/21/04
33			
34	Semi-Annual Groundwater Sampling (2nd Round)	2/10/05	3/1/05
35	Laboratory Analysis	3/2/05	3/29/05
36	Data Analysis	3/30/05	4/19/05

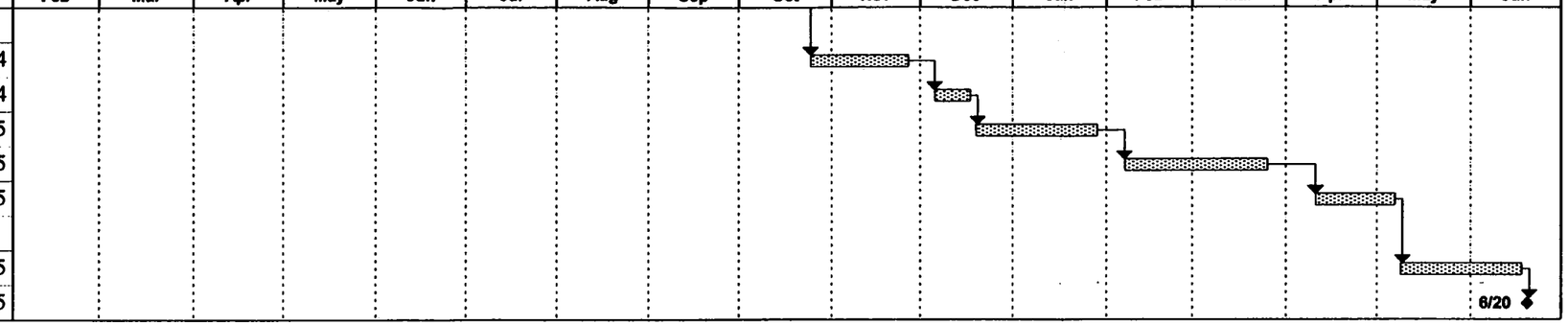


Project: Combe Fill South Landfill Superfund Site
Date: 1/27/04

Task Progress Milestone Summary

FIGURE 8 - Preliminary Schedule - Combe Fill South Landfill Remedial Investigation

ID	Task Name	Start	Finish
37			
38	Additional Research - Modeling	10/25/04	11/26/04
39	Multi-Layer Model Setup	12/6/04	12/17/04
40	Initial Parameter Estimation	12/20/04	1/28/05
41	Calibration and Verification	2/7/05	3/25/05
42	GW Capture Scenario Development	4/11/05	5/6/05
43			
44	Report Development	5/9/05	6/17/05
45	DRAFT RI Report Submission	6/20/05	6/20/05

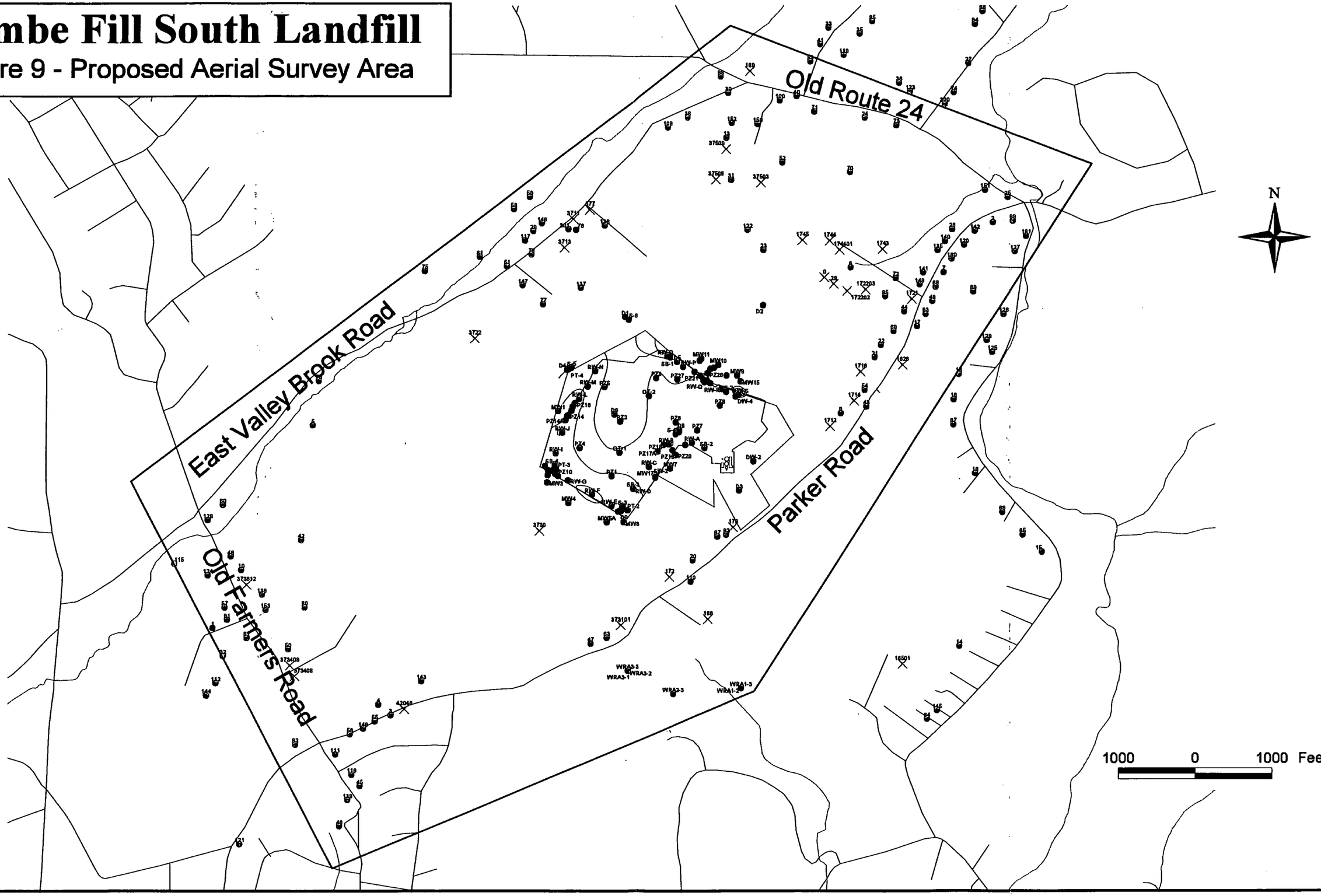


Project: Combe Fill South Landfill Superfund Site
Date: 1/27/04

Task Progress Milestone ◆ Summary

Combe Fill South Landfill

Figure 9 - Proposed Aerial Survey Area



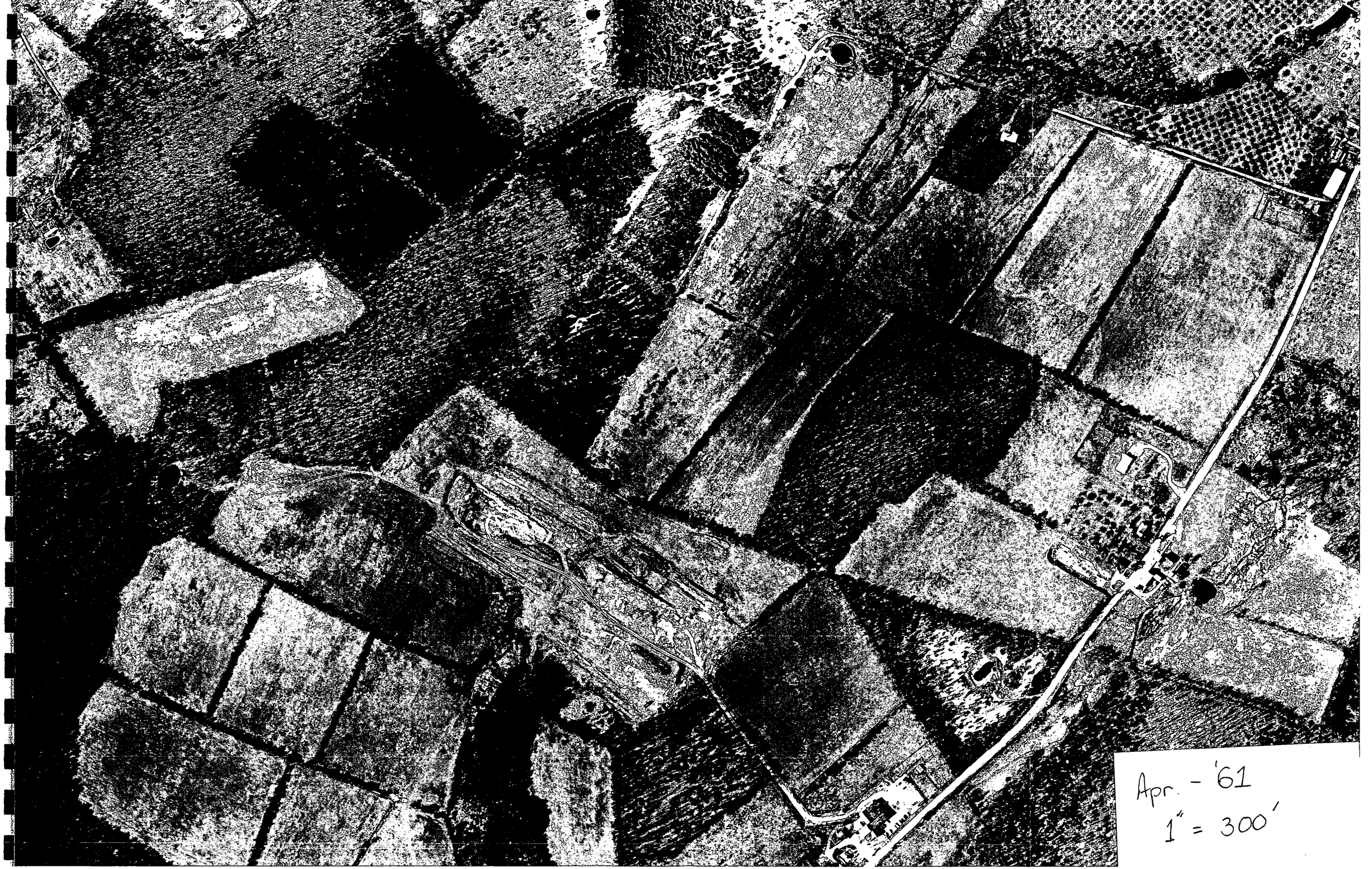
APPENDIX A
Combe Fill South Landfill
Historical Aerial Photos

DEC - '39

1" = 300'

Apr. - '51

1" = 300'



Apr. - '61
1" = 300'

Apr. - '74
1" = 300'

APPENDIX B
Combe Fill South Landfill
Analytical Data Tables and Contours

Combe Fill South Landfill – Data Tables.

Combe Fill South Landfill
1985 Monitoring Well Analytical Results

Location	GW Criteria/Interim	D-1	D-2	D-4	D-5	D-6	DW-2	DW-4	D-3	D-7	D-8	D-9	S-1	S-2	S-3	S-4	S-5	S-6
Date		8/28/85	8/28/85	8/28/85	8/28/85	8/29/85	9/5/85	9/5/85	9/4/85	9/4/85	9/4/85	9/4/85	9/4/85	9/5/85	8/29/85	9/4/85	8/28/85	8/28/85
Unit	ug/l	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
Analyte																		
Benzene	1	ND	ND	ND	**16.9**	**39.1**	ND	**252**	ND	**66.4**	**31.5**	**18.6**	**64.7**	4.4 U	**80.2**	4.4 U	ND	4.4 U
Chloroform	6	ND	**209**	**82.6**	ND	ND	ND	**155**	ND	ND	ND	ND	ND	ND	ND	ND	**57.5**	ND
Tetrachloroethene	1	ND	**14.3**	ND	**6.89**	4.1 U	ND	**5.58**	ND	ND	ND	ND	ND	ND	4.1 U	ND	ND	ND
Trichloroethene	1	ND	**8.34**	ND	**2.72**	**26**	ND	**56.8**	ND	ND	ND	ND	ND	ND	**4.04**	ND	ND	ND

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
1988 Monitoring Well Analytical Results

Location	GW Criteria/Interim	D-1	D-2	D-4	D-7	D-8	D-9
Date		12/14/88	12/15/88	12/10/88	12/15/88	12/13/88	12/9/88
Unit	ug/l	ppb	ppb	ppb	ppb	ppb	ppb
Analyte							
Benzene	1	5 U	11	5 U	5 U	5 U	5 U
Chloroform	6	5 U	**61**	**80**	5 U	5 U	5 U
Tetrachloroethene	1						
Trichloroethene	1						

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
1990 Monitoring Well Analytical Results

Location	GW Criteria/Interim	D-1	D-2	D-4	D-7	D-8	D-9
Date		6/5/90	6/8/90	6/7/90	6/5/90	6/6/90	6/6/90
Unit	ug/l	ppb	ppb	ppb	ppb	ppb	ppb
Analyte							
Benzene	1	10 U	**2 J**	**R**	**44**	**10**	**1 J**
Chloroform	6	U	**52**	U	U	U	U
Tetrachloroethene	1						
Trichloroethene	1						

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
1996 Monitoring Well Analytical Results

Location	GW Criteria/Interim	D-1	D-2	D-3	D-4	D-6	D-7	D-9	S-06
Date		1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Analyte									
Benzene	1	ND	NA	ND	**90**	NA	**10**	NA	ND
Chloroform	6	ND	NA	ND	**69**	NA	ND	NA	ND
Tetrachloroethene	1	ND	NA	ND	ND	NA	ND	NA	ND
Trichloroethene	1	ND	NA	ND	**6**	NA	ND	NA	ND

Location	GW Criteria/Interim	MW-01	MW-02	MW-03	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17
Date		1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96	1/1/96
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Analyte																		
Benzene	1	**81**	6	**16**	2	2	1	**57**	ND	ND	1	4	5	**360**	8	ND	29	5
Chloroform	6	5	ND	ND	ND	ND	ND	26	ND	ND	ND	ND	ND	29	ND	ND	ND	ND
Tetrachloroethene	1	4	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	ND	4	ND	ND	ND	ND
Trichloroethene	1	2	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
1997 Monitoring Well Analytical Results

Location	GW Criteria/Interim	D-2	D-3	D-4	D-6	D-7	D-9	SW-01	SW-02	SW-03
Date		11/5/97	11/7/97	11/5/97	11/7/97	11/6/97	11/6/97	11/6/97	11/5/97	11/5/97
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		784.7	784.7	788.87	795.03	771.46	776.49			
Elevation Date		11/20/97	11/20/97	11/20/97	11/20/97	11/20/97	10/23/97			
Analyte										
Benzene	1	**250 D**	**4**	**29**	**4**	**6**	0.6 U	**7**	0.6 J	0.6 U
Chloroform	6	0.7 U	0.7 U	**28**	0.7 U	0.7 U	0.7 U	0.7 U	0.2 J	0.2 J
Tetrachloroethene	1	**8**	0.6 U	0.6 U	0.6 U	NR U	0.6 U	0.6	0.6 U	0.6 U
Trichloroethene	1	**3**	0.8 U	**5**	0.8 U	0.8 U	0.8 U	0.5 J	0.8 U	0.8 U

Location	GW Criteria/Interim	MW-01	MW-02	MW-03	MW-04	MW-05A	MW-06	MW-07	MW-08	MW-13	MW-17
Date		11/5/97	11/5/97	11/6/97	11/6/97	11/6/97	11/6/97	11/5/97	11/5/97	11/6/97	11/5/97
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		779.53	777.12	776.81	774.63	771.23	776.37	785.92	777.53	791.95	780.9
Elevation Date		11/5/97	10/23/97	10/23/97	10/23/97	10/23/97	10/23/97	11/20/97	10/23/97	11/20/97	11/20/97
Analyte											
Benzene	1	49	2	4	2	0.9	2	99	0.6 U	120 D	13
Chloroform	6	0.7 U	NR	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Tetrachloroethene	1	3	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Trichloroethene	1	2	0.5 J	0.8 U	0.8 U	0.8 U	0.8 U	2	0.8 U	0.8 U	0.8 U

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
1998 Monitoring Well Analytical Results

Location	GW Criteria/Interim	D-1	D-2	D-4	SW-01	SW-02	SW-03	S-06
Date		5/6/98	5/6/98	5/6/98	5/6/98	5/6/98	5/6/98	5/6/98
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		810.64	790.24	785.41				
Elevation Date		4/24/98	4/24/98	5/26/98				
Analyte								
Benzene	1	10U	**460**	**9 J**	**13**	10 U	10 U	10 U
Chloroform	6	10U	**65**	**30**	2 J	10 U	10 U	10 U
Tetrachloroethene	1	10U	**11 J**	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	10U	**6 J**	**2 J**	10 U	10 U	10 U	10 U

Location	GW Criteria/Interim	MW-03	MW-07	MW-09	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Date		5/6/98	5/6/98	5/6/98	5/6/98	5/6/98	5/6/98	5/6/98	5/6/98	5/6/98	5/6/98
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		779.35	790.28	801.02	799.03	800.08	802.62	798.86		800.77	791.99
Elevation Date		4/24/98	4/24/98	4/24/98	4/24/98	4/24/98	4/24/98	4/24/98		4/24/98	4/24/98
Analyte											
Benzene	1	4 J	10 U	10 U	10 U	3 J	3 J	140	10 U	10 U	32
Chloroform	6	2 J	10 U	10 U	10 U	10 U	10 U	4 J	10 U	10 U	4 J
Tetrachloroethene	1	1 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	2 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
1998 Monitoring Well Analytical Results

Date	GW Criteria/Interim	D-2	D-3	D-4	D-6	D-7	D-9	SW-01	SW-03
Location		9/9/98	9/11/98	9/9/98	9/10/98	9/11/98	9/10/98	9/9/98	9/10/98
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		785.1	779.37	790.54	793.89	778.34	776.22		
Elevation Date		9/4/98	9/4/98	9/4/98	9/4/98	9/4/98	9/4/98		
Analyte									
Benzene	1	**140**	0.23 U	**11**	**3.2**	**4.6**	0.09 J	**21 D**	0.23 U
Chloroform	6	43 U	0.42 U	1	0.42 U	0.42 U	0.42 U	2	0.42 U
Tetrachloroethene	1	**7**	0.37 U	0.5 U	0.37 U	0/37 U	0.37 U	0.8	0.37 U
Trichloroethene	1	**3**	0.29 U	**1**	**1.3**	0.29 U	0.29 U	0.8	0.29 U

Date	GW Criteria/Interim	MW-01	MW-02	MW-03	MW-04	MW-05	MW-06	MW-07	MW-08	MW-13	MW-17
Location		9/9/98	9/10/98	9/10/98	9/10/98	9/10/98	9/10/98	9/11/98	9/9/98	9/9/98	9/9/98
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		778.98	776.89	777	774.73	771.1	776.01	785.38	783.51	793.59	780.34
Elevation Date		9/4/98	9/4/98	9/4/98	9/4/98	9/4/98	9/4/98	9/4/98	9/4/98	9/4/98	9/4/98
Analyte											
Benzene	1	150 D	4.9	3.3	1.6	0.24	1.3	110 D	0.6	88 D	28 D
Chloroform	6	22 D	0.32 J	0.42 U	0.42 U	0.42 U	0.42 U	51 D	0.8	0.3 U	0.3 U
Tetrachloroethene	1	4	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	1.2	0.5 U	0.5 U	0.5 U
Trichloroethene	1	2	0.99	0.33	0.29 U	0.29 U	0.13 J	2.5	0.08 J	0.3 J	2

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
1999 Monitoring Well Analytical Results

Location	GW Criteria/Interim	D-1	D-2	D-4	SW-01	SW-02	SW-03	S-06	MW-03	MW-07	MW-09	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Date		4/15/99	4/14/99	4/15/99	4/15/99	4/14/99	4/14/99	4/15/99	4/15/99	4/14/99	4/14/99	4/14/99	4/14/99	4/14/99	4/14/99	4/14/99	4/14/99	4/16/99
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		805.68	788.23	781.25					779.29	787.54	795.63	794.76	796.32	796.24	794.67		795.37	788.78
Elevation Date		4/16/99	4/16/99	4/16/99					4/16/99	4/16/99	4/16/99	4/16/99	4/16/99	4/16/99	4/16/99		4/16/99	4/16/99
Analyte																		
Benzene	1	10U	**110**	**6 J**	10 U	10 U	**27**	10 U	**3 J**	10 U	10 U	10 U	10 U	**1 J**	**26**	10 U	10 U	**23**
Chloroform	6	10U	**31**	**14**	10 U	10 U	5 J	10 U	2 J	**6 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1 J
Tetrachloroethene	1	10U	**5 J**	10 U	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	10U	**2 J**	**2 J**	10 U	10 U	10 U	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Location	GW Criteria/Interim	WRA 2-1	WRA 2-2	WRA 3-1	WRA 3-2	WRA 3-3	D-2	D-3	D-4	D-6	D-7	D-9	SW-01	SW-02	SW-03
Date		11/18/99	11/18/99	11/18/99	11/18/99	11/18/99	11/16/99	11/16/99	11/17/99	11/16/99	11/17/99	11/16/99	11/17/99	11/17/99	11/16/99
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation							783.79	777.44	753.23	789.59	742.61	776.98			
Elevation Date							11/19/99	11/19/99	11/19/99	11/19/99	11/19/99	11/19/99			
Analyte															
Benzene	1	10 U	10 U	10 U	10 U	10 U	**520 E**	10 U	**5 J**	**2 J**	**4 J**	10 U	10 U	10 U	**16**
Chloroform	6	10 U	10 U	10 U	10 U	10 U	**68**	10 U	**6 J**	10 U	10 U	10 U	10 U	10 U	3 J
Tetrachloroethene	1	10 U	10 U	10 U	10 U	10 U	**11**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	10 U	10 U	10 U	10 U	10 U	**6 J**	10 U	2 J	1 J	10 U	10 U	10 U	10 U	10 U

Location	GW Criteria/Interim	MW-01	MW-02	MW-03	MW-04	MW-05A	MW-06	MW-07	MW-08A	MW-13	MW-17
Date		11/18/99	11/17/99	11/17/99	11/17/99	11/16/99	11/16/99	11/17/99	11/17/99	11/16/99	11/17/99
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		776.89	777.67	778.09	775.84	771.95	776.75	784.1	783.32	788.98	779.73
Elevation Date		11/13/99	11/19/99	11/19/99	11/19/99	11/19/99	11/19/99	11/19/99	36483	11/19/99	11/19/99
Analyte											
Benzene	1	**200**	**8 J**	**3 J**	10 U	10 U	**4 J**	**26**	10 U	**42**	**18**
Chloroform	6	**40**	10 U	10 U	10 U	10 U	10 U	**17**	10 U	10 U	10 U
Tetrachloroethene	1	**3 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	**2 J**	10 U	10 U	10 U	10 U	**2 J**	10 U	10 U	10 U	**3 J**

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill
2000 Monitoring Well Analytical Results

Location	GW Criteria/Interim	MW-03	MW-07	MW-09	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Date		5/25/00	5/25/00	5/24/00	5/24/00	5/24/00	5/25/00	5/24/00	5/24/00	5/24/00	5/25/00
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		779.4	789.55	796.69	795.82	796.85	796.79	795.73		796.74	791.48
Elevation Date		5/10/00	5/10/00	5/10/00	5/24/00	5/10/00	5/10/00	5/10/00		5/10/00	5/10/00
Analyte											
Benzene	1	2 J	10 U	10 U	10 U	10 U	10 U	**29**	10 U	10 U	11
Chloroform	6	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Location	GW Criteria/Interim	WRA 1-1	WRA 1-3	WRA 2-3	D-1	D-2	D-4	SW-01	SW-02	SW-03	S-06
Date		5/25/00	5/25/00	5/25/00	5/24/00	5/25/00	5/24/00	5/25/00	5/25/00	5/25/00	5/24/00
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation					808.19	788.24	792.28				
Elevation Date					5/10/00	5/10/00	5/10/00				
Analyte											
Benzene	1	10 U	10 U	10 U	10U	**140**	**2 J**	10 U	10 U	**2 J**	10 U
Chloroform	6	10 U	10 U	10 U	10U	**37**	**12**	10 U	10 U	10 U	10 U
Tetrachloroethene	1	10 U	10 U	10 U	10U	**6 J**	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	10 U	10 U	10 U	10U	**3 J**	**1 J**	10 U	10 U	10 U	10 U

Note:
- **Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.**

Location	GW Criteria/Interim	MW-01	MW-02	MW-03	MW-04	MW-05A	MW-06	MW-07	MW-08A	MW-13	MW-17
Date		10/19/00	10/18/00	10/18/00	10/18/00	10/18/00	10/18/00	10/18/00	10/18/00	10/19/00	10/19/00
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		783.02	780.6	778.16	775.26	771.42	775.86	785.22	783.35	792.44	780.32
Elevation Date		10/24/00	10/24/00	10/24/00	10/24/00	10/24/00	10/24/00	10/24/00	10/24/00	10/24/00	10/24/00
Analyte											
Benzene	1	130	12	3 J	10 U	10 U	2 J	57	10 U	45	9 J
Chloroform	6	32	10 U	10 U	10 U	10 U	10 U	23	10 U	10 U	10 U
Tetrachloroethene	1	4 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	3 J	1 J	10 U	10 U	10 U	1 J	1 J	10 U	10 U	2 J

Location	GW Criteria/Interim	WRA 1-1	WRA 1-2	WRA 1-3	WRA 2-1	WRA 2-2	WRA 2-3	WRA 3-1	WRA 3-2	WRA 3-3	D-2	D-3	D-4	D-6	D-7	D-9	SW-01	SW-02	SW-03
Date		11/1/00	11/1/00	11/1/00	11/1/00	11/1/00	11/1/00	11/1/00	11/1/00	11/1/00	10/19/00	10/18/00	10/19/00	10/19/00	10/18/00	10/18/00	10/18/00	10/18/00	10/19/00
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation											784.81	778.58	780.37	792.34	763.23	776.34			
Elevation Date											10/24/00	10/24/00	10/24/00	10/24/00	10/24/00	10/24/00			
Analyte																			
Benzene	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**420**	10 U	**4 J**	10 U	**2 J**	10 U	10 U	10 U	**25**
Chloroform	6	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**48**	10 U	**14**	10 U	10 U	10 U	10 U	10 U	2 J
Tetrachloroethene	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**9 J**	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	**5 J**	10 U	**1 J**	10 U	10 U	10 U	10 U	10 U	10 U

Combe Fill South Landfill
2001 Monitoring Well Analytical Results

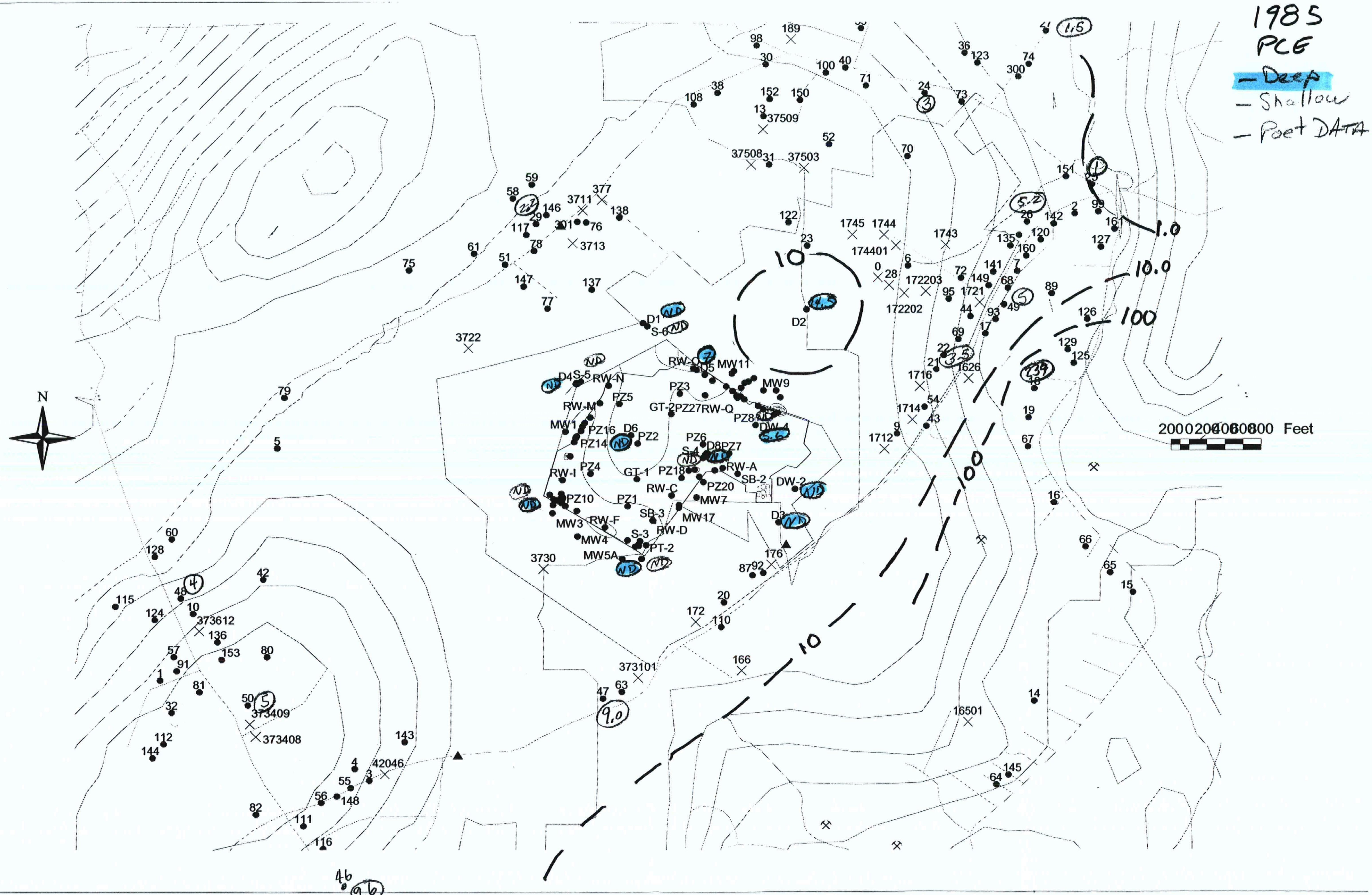
Location	GW Criteria/Interim	D-1	D-2	D-4	SW-01	SW-02	SW-03	S-06
Date		4/19/01	4/18/01	4/19/01	4/19/01	4/19/01	4/18/01	4/19/01
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		811.34	789.23	782.26				
Elevation Date		4/27/01	4/27/01	4/27/01				
Analyte								
Benzene	1	10U	**290 EJ**	**4 J**	10 U	10 U	**3 J**	10 U
Chloroform	6	10U	**44**	**12**	10 U	10 U	10 U	10 U
Tetrachloroethene	1	10U	**7 J**	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	10U	**4 J**	**1 J**	10 U	10 U	10 U	10 U

Location	GW Criteria/Interim	MW-01	MW-03	MW-07	MW-09	MW-10	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16
Date		4/19/01	5/24/01	4/19/01	4/18/01	4/18/01	4/18/01	4/18/01	5/24/01	4/18/01	4/18/01	4/19/01
Unit	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GW Elevation		783.87	779.47	787.58	798.27	797.26	798.21	798.15	795.91		798.31	792.22
Elevation Date		4/27/01	5/24/01	4/27/01	4/27/01	4/27/01	4/27/01	4/27/01	5/29/01		4/27/01	4/27/01
Analyte												
Benzene	1	27	2 J	10 U	10 U	10 U	10 U	10 U	30	10 U	10 U	7 J
Chloroform	6	13	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	1	2 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1	1 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Note:

- Shaded and bolded values meet or exceed NJDEP Ground Water Quality Criteria.

Combe Fill South Landfill – PCE Contours


1985
PCE
– Deep
– Shallow
– Post DATA
N
2000 2000 4000 6000 8000 Feet
10
10.0
1.0
100
10
100
10
ND
14.5
5.2
3.5
239
9.0
9.6
4
5
3
1.5
D1
S-6
D2
D3
D4
S-5
RW-N
RW-M
MW1
PZ16
D6
PZ2
PZ14
PZ5
PZ3
GT-2
PZ27
RW-Q
PZ8
DW-4
MW9
MW11
D5
PZ6
D8
PZ7
S-4
RW-A
SB-2
DW-2
PZ18
GT-1
PZ4
RW-I
RW-C
PZ20
MW7
MW17
PZ10
PZ1
SB-3
MW3
RW-F
MW4
S-3
RW-D
PT-2
MW5A
3730
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3711
3713
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1744
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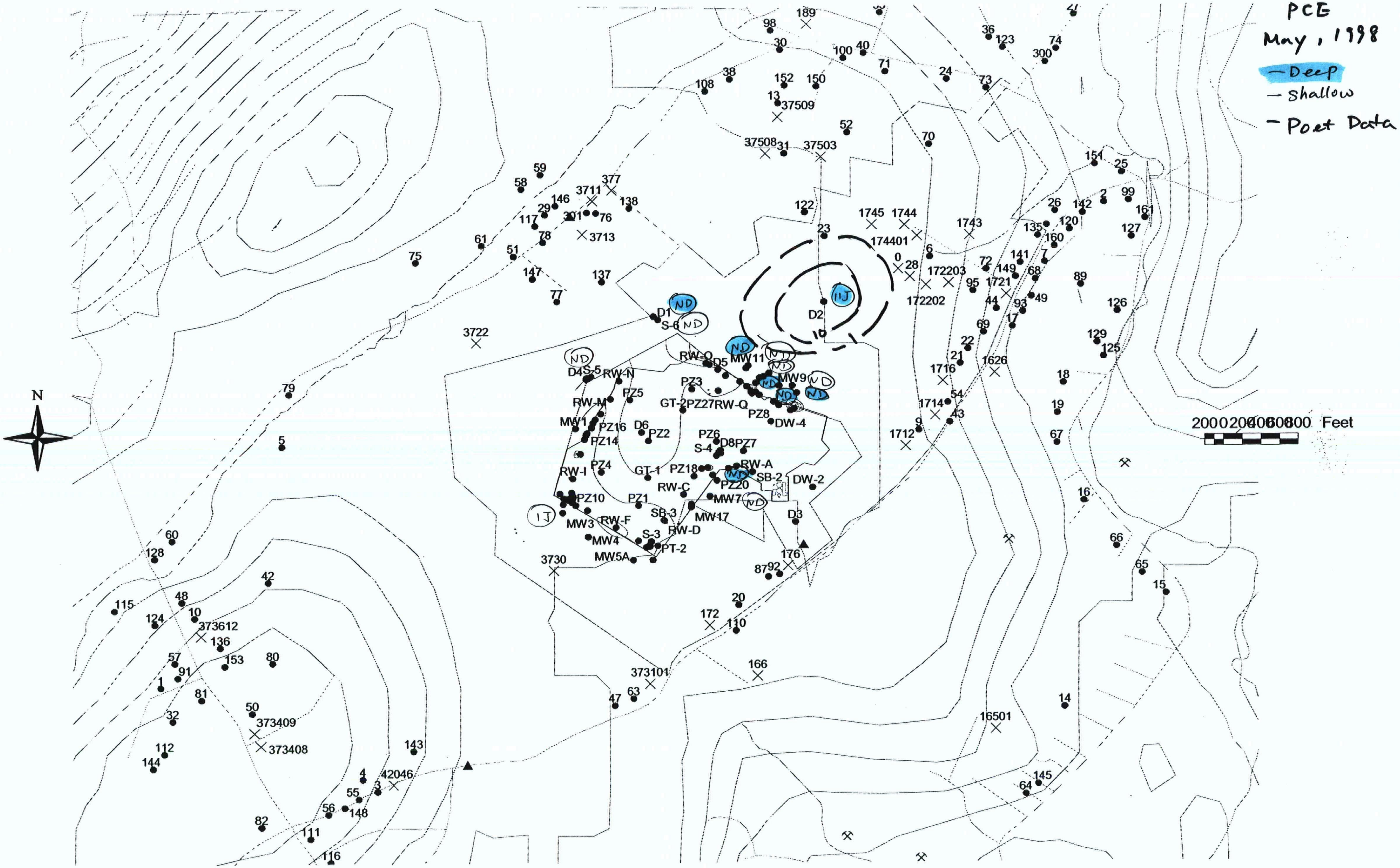
172202
1721
1716
1626
1714
1712
16501
373612
373409
373408
373101
42046
37509
37508
37503

PCE
May, 1998
— Deep
— Shallow
— Post Data

N

2000 200 400 600 800 Feet

ND
IJ

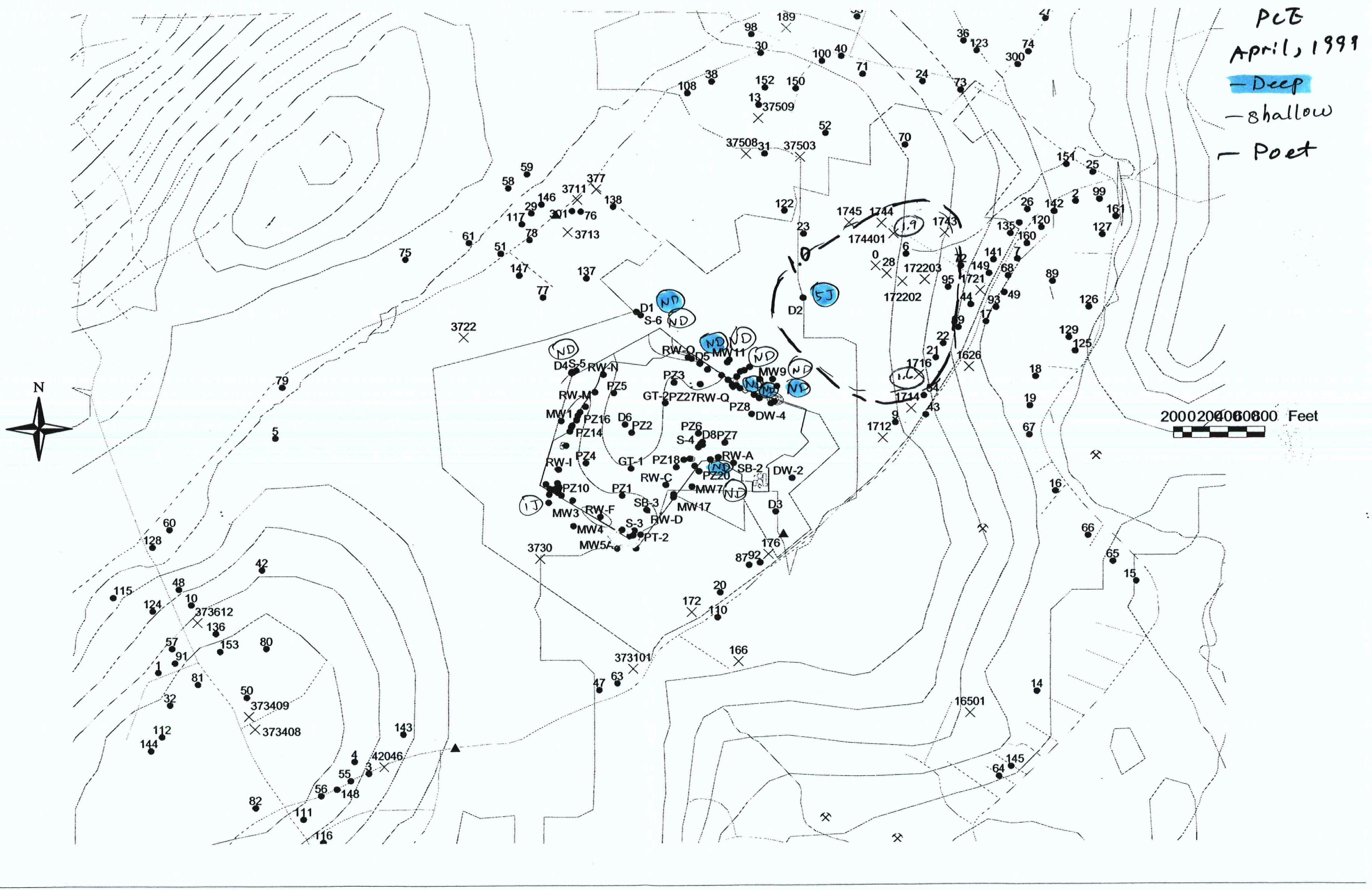

PCE
May, 1998
— Deep
— Shallow
— Post Data
N
2000 2000 4000 6000 8000 Feet
ND
11J
1J
10
D1
S-6
D2
D4
S-5
RW-N
RW-O
D5
MW11
MW9
PZ3
PZ5
RW-M
GT-2
PZ27
RW-Q
PZ8
DW-4
MW1
PZ16
D6
PZ2
PZ14
PZ6
S-4
D8
PZ7
PZ4
RW-I
GT-1
PZ18
RW-A
SB-2
DW-2
RW-C
PZ20
PZ10
PZ1
MW7
SB-3
MW17
D3
MW3
RW-F
S-3
RW-D
MW4
PT-2
MW5A
3722
3730
3711
3713
377
37508
37509
37503
174401
172203
172202
1745
1744
1743
1721
1716
1626
1714
1712
373612
373409
373408
373101
42046
16501

PCE
Sept. 1998
– Deep
– Shallow
– Poet

N

2000 2000 4000 6000 8000 Feet

D1 S-6 D2 D3 D4 S-5 D5 D6 D8 S-3 S-4 S-6
RW-A RW-C RW-D RW-F RW-I RW-M RW-N RW-Q
PT-2 SB-2 SB-3
DW-2 DW-4
GT-1 GT-2
MW1 MW3 MW4 MW5A MW7 MW9 MW11 MW17
PZ1 PZ2 PZ3 PZ4 PZ5 PZ6 PZ7 PZ8 PZ10 PZ14 PZ16 PZ18 PZ20 PZ27
3711 3713 3722 3730 3792 373101 373408 373409 373612 37503 37508 37509 42046 16501 172202 172203 174401 1712 1714 1716 1721 1626 1743 1744 1745


PCE
April, 1999
— Deep
— shallow
— Poet
N
2000 2000 4000 6000 8000 Feet
ND
5J
1.9
1.6
1J
D1
S-6
D2
D3
D4
D5
D6
D8
S-4
S-5
S-3
SB-2
SB-3
DW-2
DW-4
RW-A
RW-C
RW-D
RW-F
RW-I
RW-M
RW-N
RW-O
RW-Q
GT-1
GT-2
PT-2
MW1
MW3
MW4
MW5A
MW7
MW9
MW11
MW17
PZ1
PZ2
PZ3
PZ4
PZ5
PZ6
PZ7
PZ8
PZ10
PZ14
PZ16
PZ18
PZ20
PZ27
3722
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3711
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37508
37503
37509
174401
172203
172202
1745
1744
1743
1716
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1712
1721
1626
16501
373101
373612
373409
373408
42046

PCE
Nov. 1999
— Deep
— shallow
— Poet

N

2000 200 400 600 800 Feet

ND

PCE
May, 2000
— Deep
— shallow
— Poet

N

0 200 200 400 600 800 Feet

1.0

15

6J

ND

PCE
Oct, 2000
– Deep
– Shallow
– Poet

1.0

N

0 200 200 400 600 800 Feet

D1 S-6 D2 D3 D4 S-5 D5 D6 D8 D-2 DW-4 GT-1 GT-2 MW1 MW3 MW4 MW5A MW7 MW9 MW11 MW17 PT-2 PZ1 PZ2 PZ3 PZ4 PZ5 PZ6 PZ7 PZ8 PZ10 PZ14 PZ16 PZ18 PZ20 PZ27 RW-A RW-C RW-D RW-F RW-I RW-M RW-N RW-Q S-3 S-4 SB-2 SB-3

9J 4T L T

189 ND, 98, 30, 100, 40, 71, 24, 73, 36, 123, 74, 300, 108, 38, 152, 150, 13, 37509 ND, 52 ND, 37508, 31, 37503 ND, 70 ND, 151 ND, 25, 59, 58, ND, 377, ND, 3711, 146, 29, 117, 301, 76, 138, 122, ND, 1745, 1744, 1743, 174401, 6 ND, 23, 26, 142, 2, 99, 161, 135, 120, 160, 127, 61, 78, 3713 ND, 75, 51, 147, 137, 77 ND, 0, ND, 28, 172203, 72, 149, 68, 141, 7, 89, 95, 1721, ND, 172202, ND, 44, 93, 49, 126, 69, 17, 22, 21, 129, 125, 3722 ND, ND, 1716, 1626, ND, 18, 54, 1714, 43, 19, 9, ND, 1712 ND, 67, 79, 5 ND, 16, 66, 65, 15, 60, 128, 42, 115, 48, 124, 10, ND, 373612, 136, 20, 172, ND, 110, 57, 91, 153, 80, 1, 81, 373101, 166 ND, 47, 63, ND, 14, 32, 50, ND, 373409, 373408, ND, 16501 ND, 112, 144, 143, 4, 42046, 3, 55, 145, 64, 56, 148, 82, 111, 116, 3730, ND, 8792, 176 ND

PCE
April, 2001
— Deep
— Shallow

N

2000 2000 4000 6000 8000 Feet

-1.0

-1.0

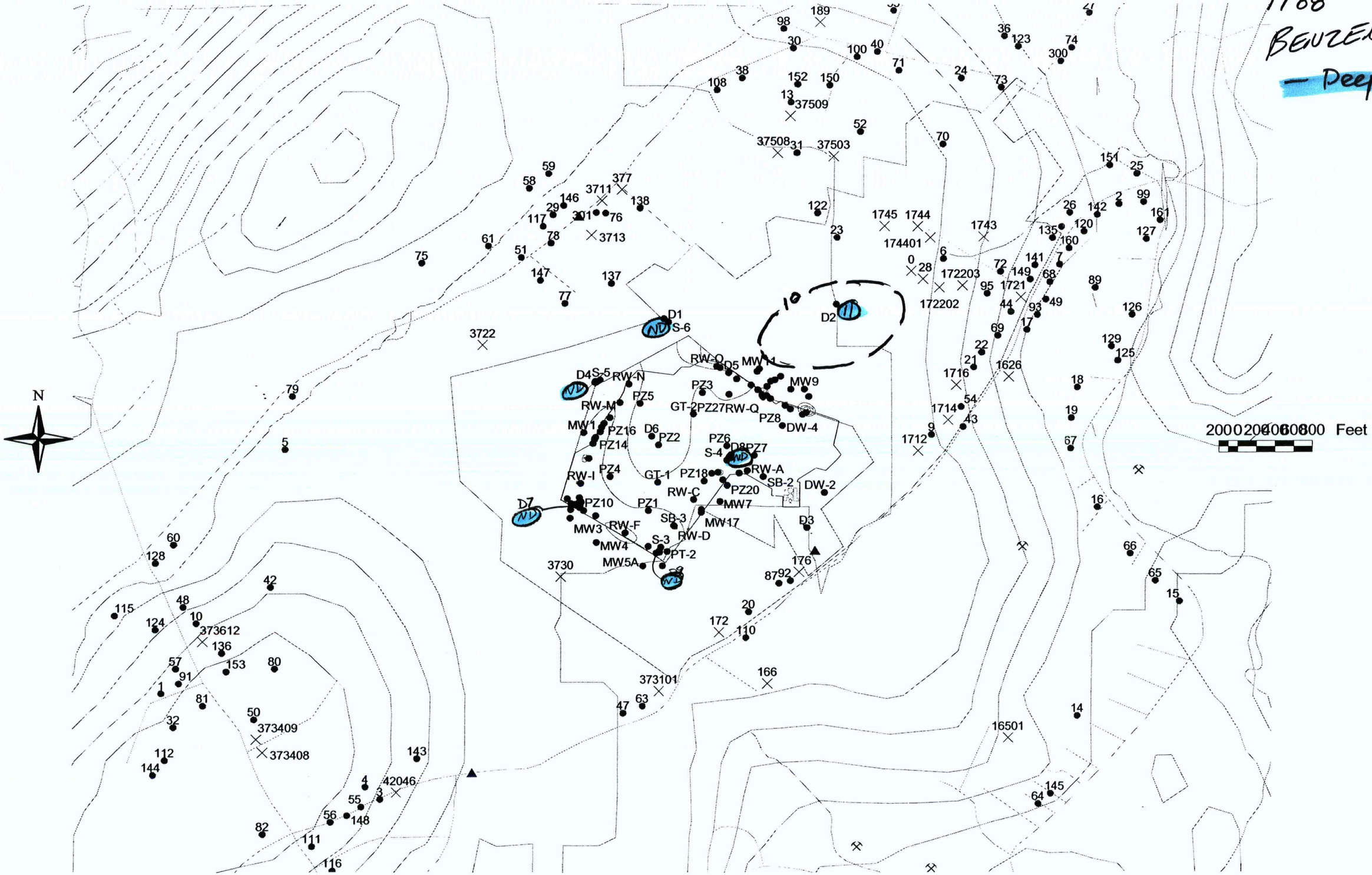
2J

7J

ND

Combe Fill South Landfill – Benzene Contours

1988
BENZENE
— Deep



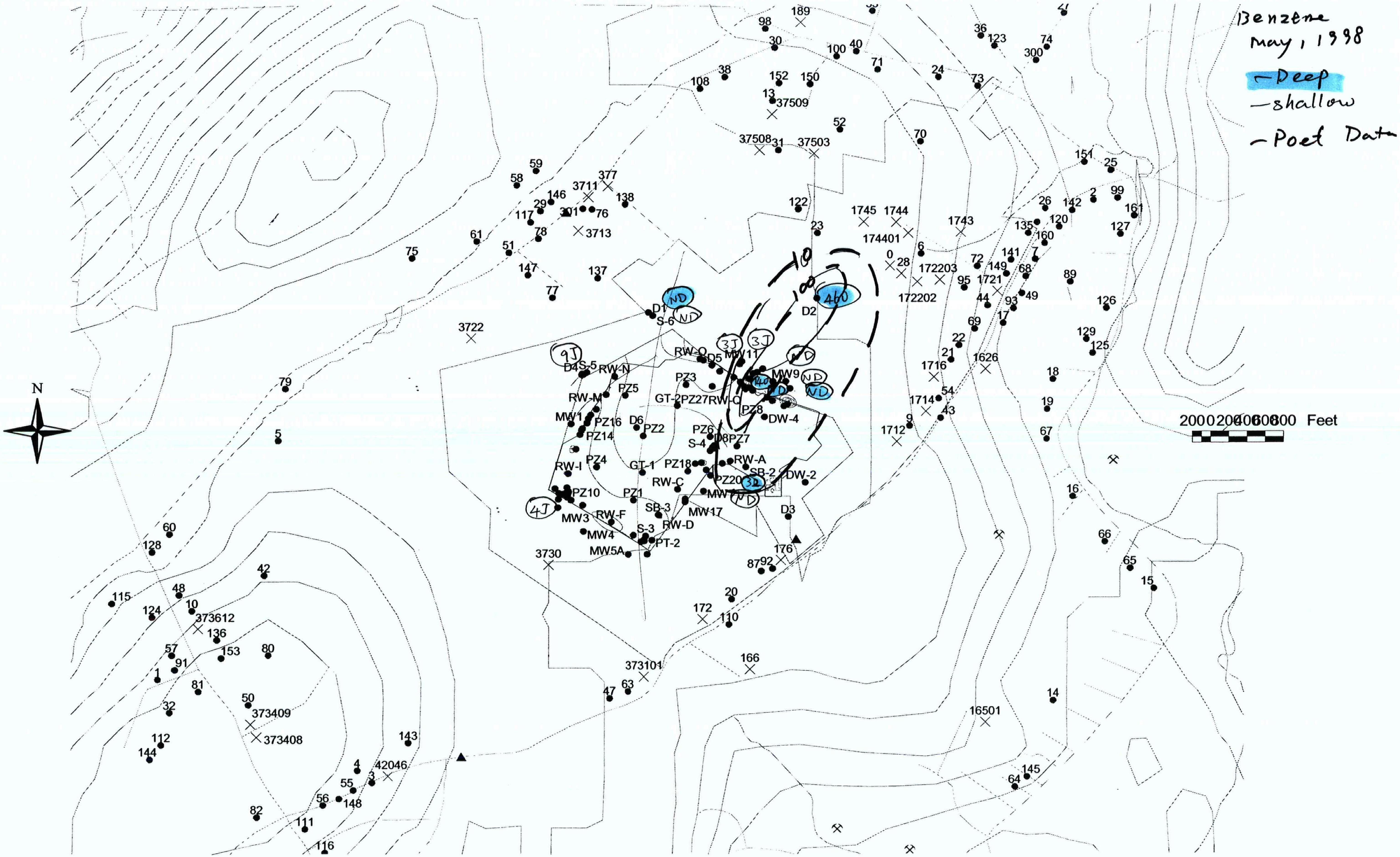
1990
BENZENE
— Deep

N

0 200 200 400 600 800 Feet

RW-Q D5 MW11 MW9 PZ3 PZ5 RW-M RW-N D4 S-5 NB GT-2 PZ27 RW-Q PZ8 DW-4 MW1 PZ16 D6 PZ2 PZ6 D8 PZ7 PZ14 S-4 10 RW-A PZ4 RW-I GT-1 PZ18 SB-2 DW-2 PZ20 RW-C PZ10 PZ1 MW7 SB-3 MW17 D3 MW3 RW-P S-3 RW-D MW4 PT-2 MW5A D9 D7 44 10 1J D2 23 D S-6 NB

189 98 30 100 40 71 108 38 152 150 13 37509 52 37508 31 37503 70 24 73 36 123 74 300 41 151 25 2 99 161 26 142 120 135 160 127 1745 1744 174401 1743 23 122 6 0 28 172203 95 1721 72 149 141 7 68 89 44 93 49 126 69 17 129 125 22 21 1626 1716 18 54 1714 43 19 9 1712 67 16 66 65 15 3722 3711 377 138 146 29 117 301 76 3713 59 58 61 51 78 75 147 137 77 79 5 60 128 115 124 48 10 42 373612 136 153 80 57 91 1 81 50 373409 373408 32 112 144 143 4 42046 3 55 56 148 82 111 116 3730 8792 176 20 172 110 373101 166 47 63 16501 14 64 145


Benzene
May, 1998
-Deep
-shallow
-Poet Data
N
2000 2000 4000 6000 8000 Feet
460
ND
40
32
9J
4J
3J
10
100
D1
S-6
D2
D3
D4
D5
D6
D8
S-3
S-4
S-5
MW1
MW3
MW4
MW5A
MW9
MW11
MW17
PZ1
PZ2
PZ3
PZ4
PZ5
PZ6
PZ7
PZ8
PZ10
PZ14
PZ16
PZ18
PZ20
PZ27
GT-1
GT-2
RW-A
RW-C
RW-D
RW-F
RW-I
RW-M
RW-N
RW-O
SB-2
SB-3
DW-2
DW-4
PT-2
3722
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174401
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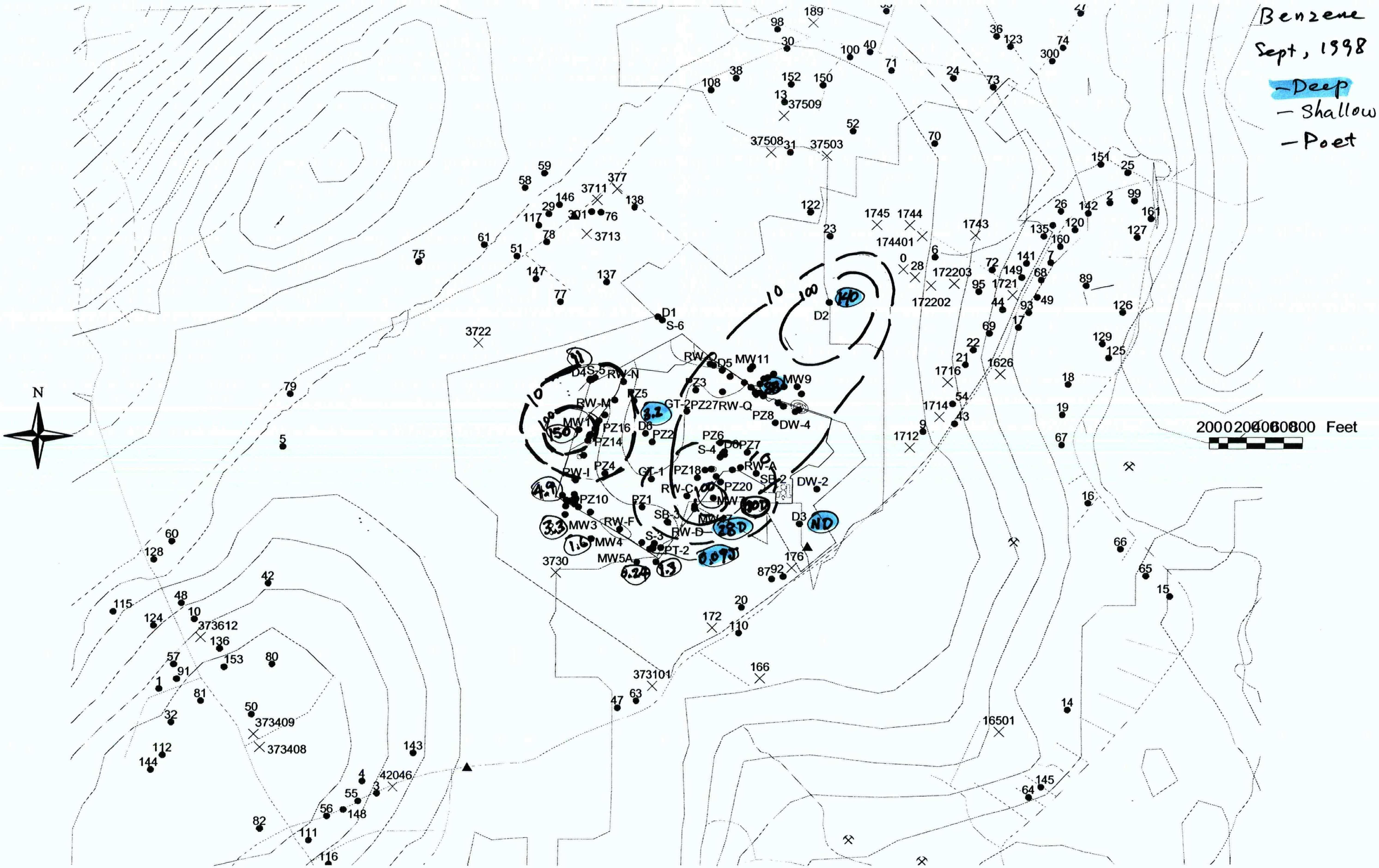
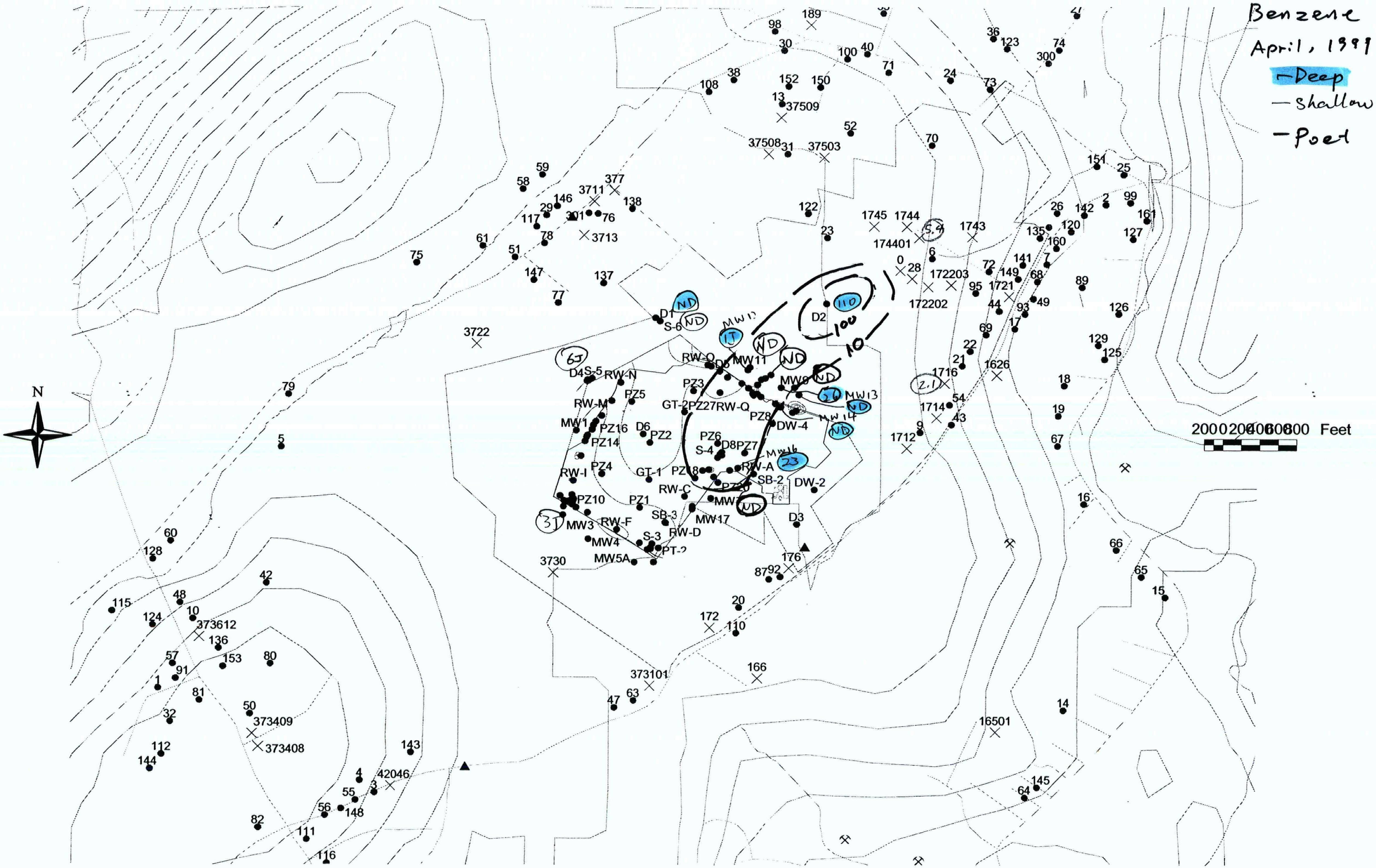
42046



Benzene
Sept, 1998
—Deep
—Shallow
—Poet
N
2000 2000 4000 6000 8000 Feet



Benzene
April, 1999
-Deep
-Shallow
-Poet
N
2000 2000 4000 6000 8000 Feet
D1
S-6
D2
MW11
MW9
MW13
MW14
MW16
MW17
MW1
MW3
MW4
MW5A
RW-Q
RW-N
RW-M
RW-I
RW-F
RW-D
RW-C
RW-A
PZ1
PZ2
PZ3
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PZ7
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PZ14
PZ16
D3
D4
D6
D8
S-3
S-4
S-5
SB-2
SB-3
DW-2
DW-4
GT-1
GT-2
PT-2
ND
110
100
10
1J
6J
3J
2.1
5.4
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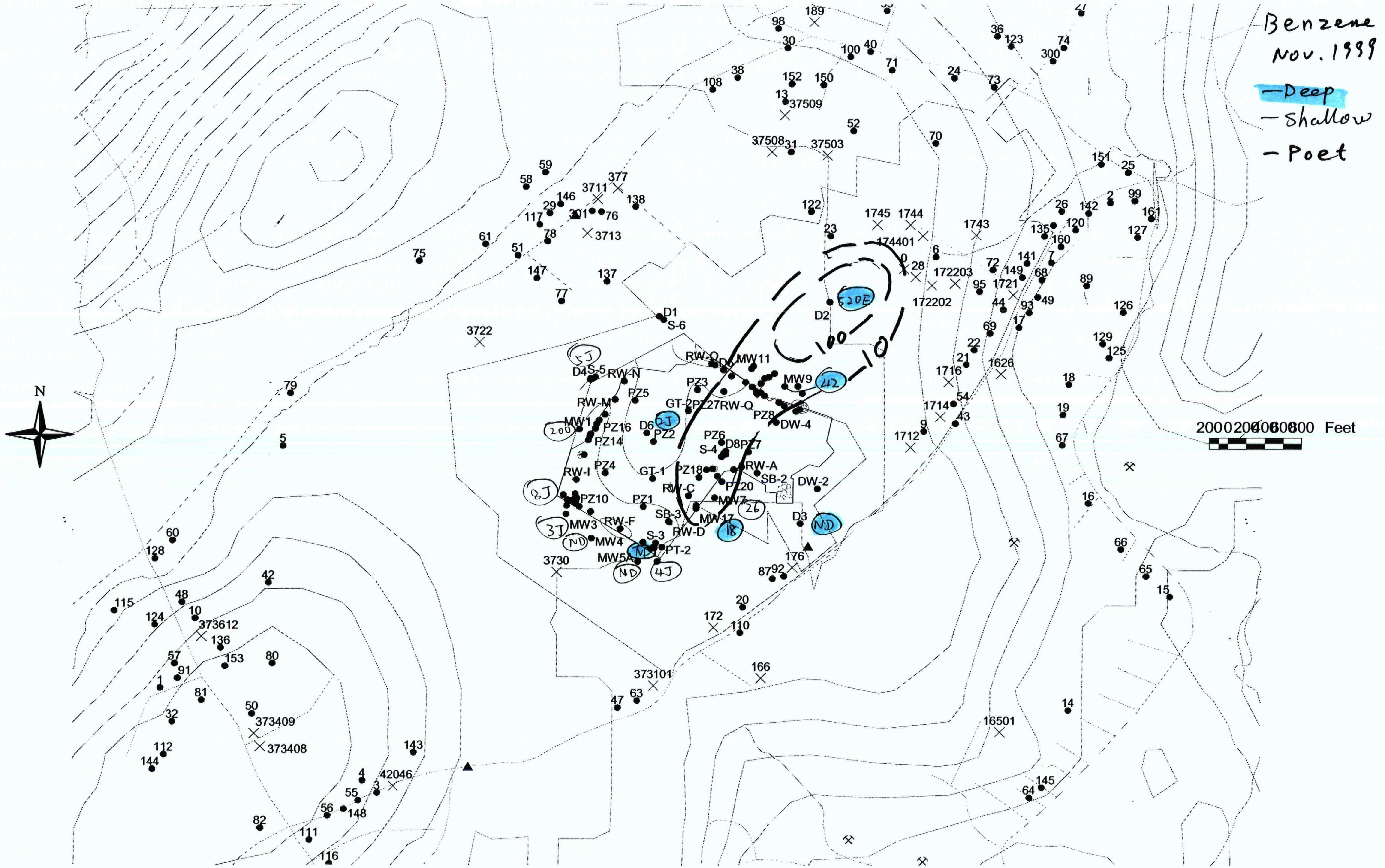
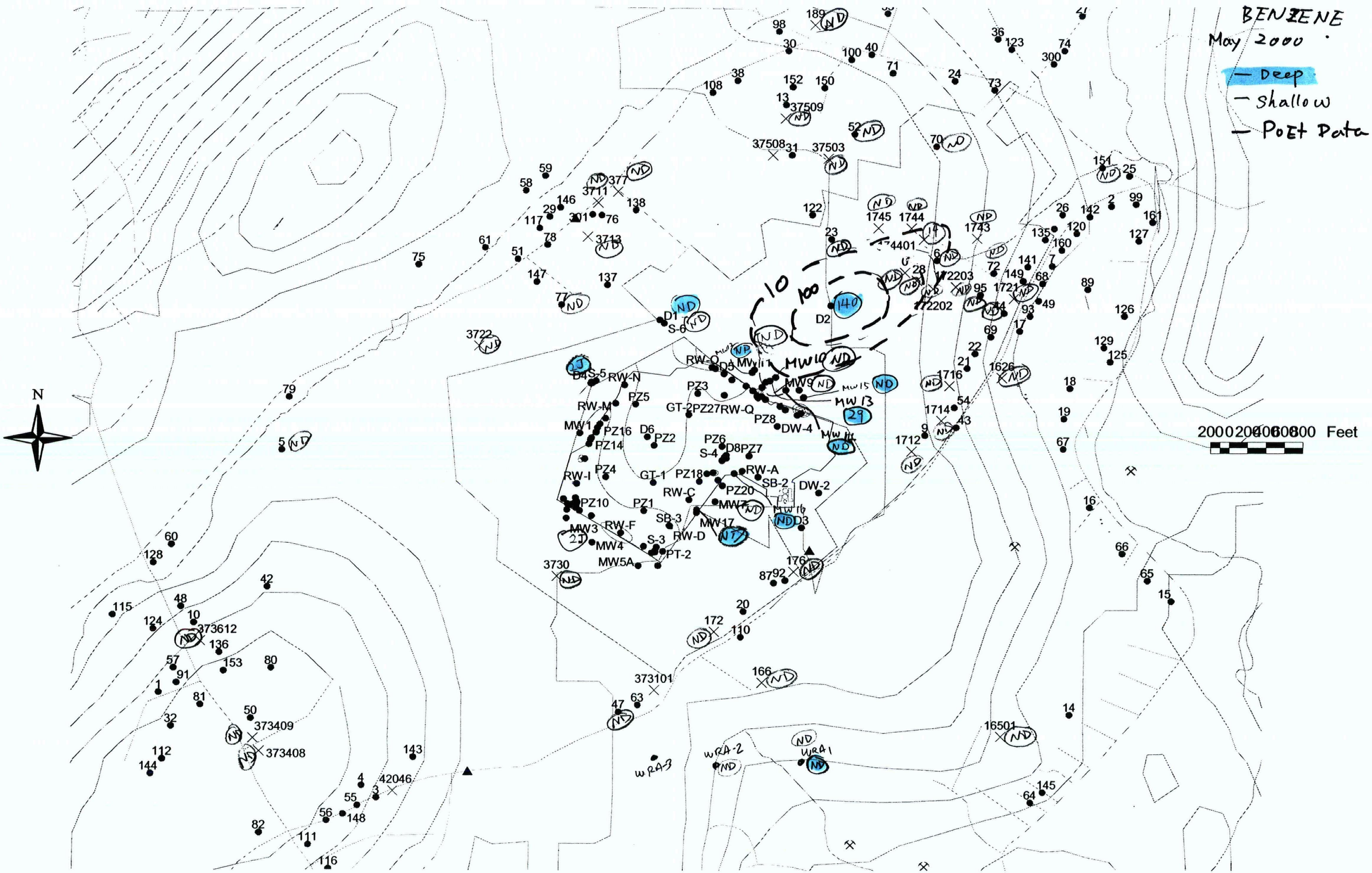
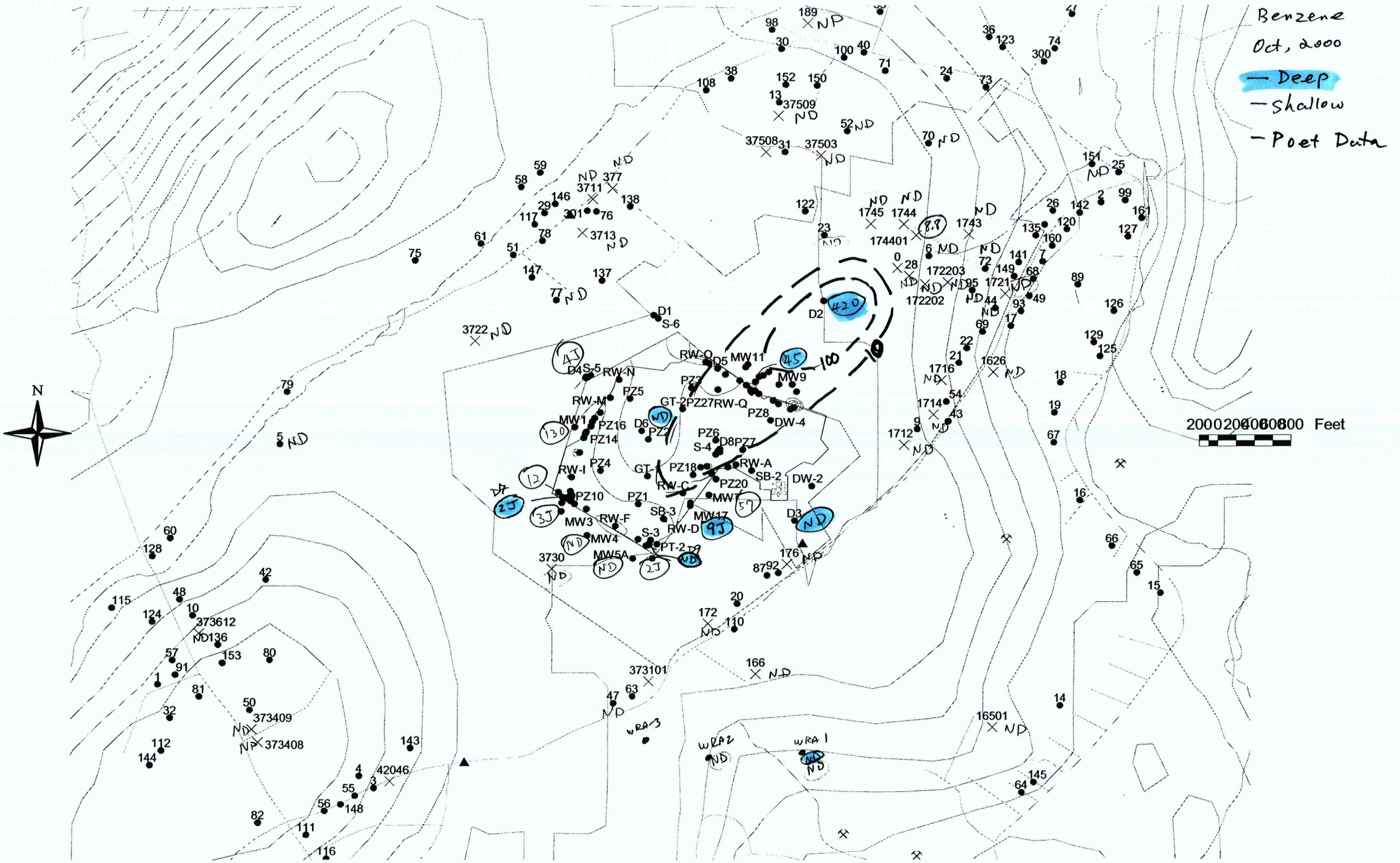

Benzene
Nov. 1999
—Deep
—Shallow
—Poet
N
2000 2000 4000 6000 8000 Feet


BENZENE
May 2000
— Deep
— Shallow
— PoEt Data
N
Feet


Benzene
Oct, 2000
— Deep
— shallow
— Poet Data
N
Feet

Benzene
April, 2001
— Deep
— Shallow

N

2000 2000 4000 6000 Feet

WRA X-1 = Deep
X-2 = Intermed
X-3 = Shallow